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contents

Vol. 17 No. 3

FEATURES

COLUMNS

DEPARTMENTS

On The Cover. Main photo: Steve Hicks, N5AC, displays his microwave station that he used as a rover; for details see the feature article by KØNR on page 20. Top right inset photo: Closeup view of the WB8ELK micro payload; for details see "Up In The Air, " by WB8ELK on page 48. Bottom right inset photo: Hector Martinez, CO6BF, operating Field Day this past June; for details see page 30.

CQ VHF Ham Radio Above 50 MHz

LINE OF SIGHT

A Message from the Editor

Fake

The one-word headline on the cover of the October 2013 issue of *IEEE Spectrum* was "FAKE." It appeared below a smoking IC. For me, the headline and graphic did their job: They caught my attention. I turned to page 40 to see what the fire alarm was all about. I quickly learned that it was about something that all of us need to know: Repackaging used components and selling them as new.

The article entitled "Chop-shop Electronics," by John Villasenor and Mohammad Tehranipoor, leads with a chilling story of a warning notice that Boeing sent to the U.S. Navy concerning an ice-detection module that was installed in the new P-8A Poseidon recon aircraft. That notice informed the Navy of a "reworked part that should not have been put on the airplane originally and should be replaced immediately."

Then the authors explain how a supposedly new Xilinx field-programmable gate array (FPGA) failed. It appears that somewhere upstream in the supply chain, apparently a company sold old, relabeled parts as new to the subcontractor.

Concerning this growing problem in the industry, the authors make this point:

> Recycled parts, relabeled and sold as new, threaten not only military systems but also commercial transportation systems, medical devices and systems, and the computers and networks that run today's financial markets and communications systems (p. 42).

From the Unethical to the Unintended Consequences

Villasenor and Tehranipoor point out that most of the time recycling old components is a good thing. Taking potentially toxic components out of circulation and disposing of them is a positive environmental activity. However, they state:

> Some companies have built a business model based on pulling old parts from cast-off products and reselling them as new. Relabeled or otherwise altered parts masquerading as new can fail prematurely in critical systems, such as those in airplanes and cars, with potentially catastrophic results.

While the counterfeiters' targeting the military is cause for deep concern from a tactical preparedness standpoint, it remains only part of the scary story. For the counterfeiters the commercial market is an even more attractive market because it is "much larger and more diversified, the level of testing is lower, and product life cycles are often shorter… [These inviting conditions provide] counterfeiters with more opportunities to sell their wares" (p. 45).

For example, as I was preparing this editorial my neighbor called me and asked me to go over to his house and look at his television because "the picture keeps going out." It is a relatively new sophisticated plasma screen HDTV, for which my neighbor paid a lot of money. His lament to me was why did his TV quit working just at the peak of football season?

The problem was the video would quit after a few minutes while the audio continued functioning normally. I performed several tests and determined that a component was failing after the TV had been on for only a few minutes.

It is unnerving for any of us to be faced with the prospects of having to box up, return, and be without something that we spent lots of money to acquire. What was particularly disconcerting for my neighbor was that because he is visually impaired, he has to rely on others to help him with his transportation needs. In this case, he would have to find someone with a truck or other suitable vehicle to transport that large TV back to the store. Additionally, he would have to wait for that person to fit my neighbor's transportation needs into his or her schedule—and also be obliged to give that person some remuneration for his or her troubles.

While I walked back home, I thought about this editorial and wondered if the failing component was counterfeit. Now, I have no way of knowing that this particular TV was victimized by a counterfeit component. Even so, my point is that the unintended consequences of the actions of these counterfeiters range from annoyance for some consumers to major inconvenience and unnecessary expenses for others.

We amateur radio operators are not exempt from this growing counterfeiting problem. There are dozens of hamfests across the country, many of which have swap tables that contain all kinds of goodies, the origins of which range from well-documented to well…unknown. Most of the time we make our purchase without questioning the seller as to where he or she acquired the parts. Sometimes we take our purchase home and install it into our project, apply power, and watch the smoke rise.

When that component failure occurs, generally we blame ourselves for it. We think that we did something wrong. We never think that the component was the culprit. The bottom line is that we amateur radio operators need to be aware of the growing problems of questionably reliable and relabeled parts. Villasenor and Tehranipoor conclude their article with this warning that applies equally to us:

> Now that electronic products are everywhere, the threat of recycled electronics parts is everywhere as well. Although we will never be able to eliminate the threat of recycled components completely, we can and should reduce the risks they pose (p. 45).

The bottom line for us amateurs is that we need to be more vigilant in our purchases. We are notorious for our cheapness. We look for bargains anywhere and everywhere.

However, rather than looking for the cheapest product, the best deal, we need to look for reliable distributers that carry quality products. Because, if we are not vigilant, then we not only are victimized by the counterfeiters, by our unwittingly purchasing these relabeled components, we are also providing the bad guys with more funds in which to perpetuate their victimization of all of us users of electronics components.

My New QTH

As of mid-November, 2013 I will be at work at my new job, Director of Religious Education at the U.S. Military Academy at West Point in New York. I expect to be living in Highland Falls, New York, just outside of the Academy.

I plan on continuing my editing this, your magazine, as well as writing the "VHF-Plus" column for *CQ* magazine. From my new QTH I look forward to making new friends in this part of the country.Until next time, 73 de Joe, N6CL

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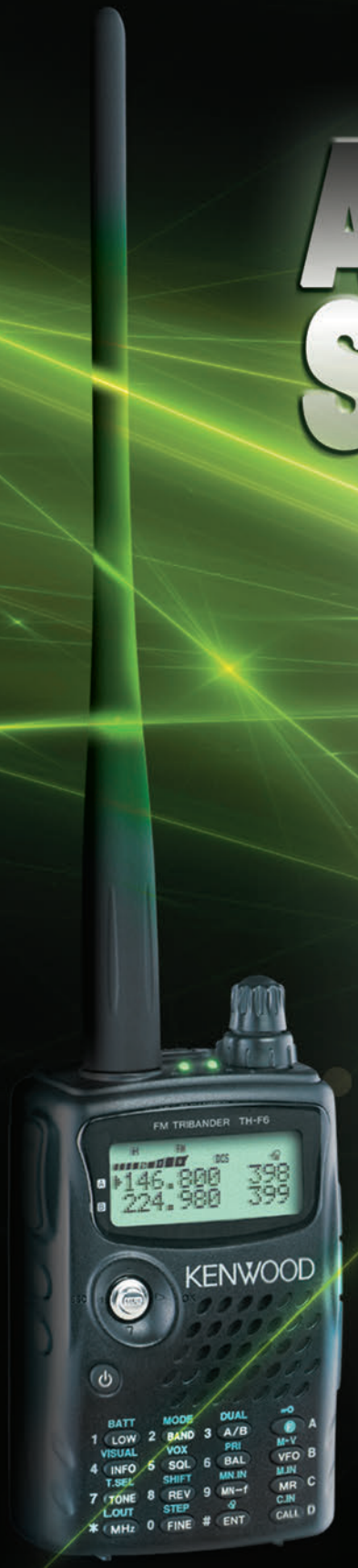

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QUARTERLY CALENDAR OF EVENTS

Quarterly Calendar

Nov. 3	New Moon
Nov. 3	Hybrid solar eclipse will be visible in Eastern Americas, Southern Europe, and Africa
Nov. 16-17	ARRL International EME Competition (50–1296 MHz Round 2)
Dec. 2	New Moon
Dec. 4	Moon perigee
Dec. 9	First quarter Moon
Dec. 13	*Geminids* meteor shower
Dec. 17	Full Moon
Dec. 19	Moon apogee
Dec. 22	*Ursids* meteor shower
Dec. 25	Last quarter Moon
Jan. 1, 2014	New Moon
Jan. 1, 2014	Moon perigee
Jan. 3, 2014	*Quadrantids* meteor shower
Jan. 8, '14	First quarter Moon
Jan. 16, '14	Full Moon
Jan. 16, '14	Moon apogee
Jan. 18-20, '14	Jan. VHF QSO Party
Jan. 24, '14	Last quarter Moon
Jan. 30, '14	New Moon
Jan. 30, '14	Moon perigee
Feb. 6, '14	First quarter Moon
Feb. 12, '14	Moon apogee
Feb. 14, '14	Full Moon
Feb. 22, '14	Last quarter Moon
Feb. 27, '14	Moon perigee

Current Contests

November: The ARRL International EME Competition (50–1296 MHz Round 2) is November 16–17, 2013.

January: The ARRL VHF Sweepstakes is scheduled for the weekend of January 18–20, 2014. For ARRL contest rules, see the issue of *QST* prior to the month of the contest or the League's URL: <http://www.arrl.org>.

Current Meteor Showers

November: the *Leonids* is predicted to peak on November 17, 2013, either 1000 or 1600 UTC. As with last year's shower, this year's peak may go largely unnoticed.

December: Two showers occur this month. The first, the *Geminids*, is predicted to peak around 0545 UTC on December 13. The actual peak can occur 2.5 hours before or after the predicted peak. It has a broad peak and is a good north-south shower producing an average of 60 meteors per hour at its peak.

The second, the *Ursids*, is predicted to peak around 1400 UTC on December 22. It is an east-west shower, producing an average of no greater than 10 meteors per hour, with the very rare possibility of upwards of 90 meteors at its peak.

January: The *Quadrantids,* or *Quads*, is a brief, but very active meteor shower. The expected peak is around 1930 UTC on January 3, 2014, with up to 40 meteors per hour predicted. The actual peak can occur three hours before or after the predicted peak. The best paths are north-south. Long-duration meteors can be expected about one hour after the predicted peak.

For more information on the above meteor shower predictions see Tomas Hood, NW7US's VHF Propagation column elsewhere in this issue. Also visit the International Meteor Organization's website: <http://www.imo.net>.

Calls for Papers

Calls for papers are issued in advance of forthcoming conferences either for presenters to be speakers, or for papers to be published in the conferences' *Proceedings*, or both. For more information, questions about format, media, hardcopy, e-mail, etc., please contact the person listed with the announcement. The following organization or conference organizer has announced a call for papers for its forthcoming conference:

The **Society of Amateur Radio Astronomers** (SARA, <http://www. radio-astronomy.org/>) is seeking papers for its 2014 Western Regional Conference. The event takes place March 22–23, 2014, in Bishop, California, and at the Owens Valley Radio Observatory (http://www.ovro.caltech.edu/).

Papers are welcome on subjects directly related to radio astronomy, including hardware, software, education and tutorials, research strategies, observations, space weather, geomagnetism and solar radio, data collection, and philosophy.

SARA members and supporters wishing to present a paper should e-mail a letter of intent to the conference coordinator, including a proposed title and abstract no later than December 31, 2013. Include full name, affiliation, postal address, and e-mail address, and indicate whether you are willing to attend the conference to present your paper. Formal printed *Proceedings* will be published for this conference, and all presentations can be made available on CD. Additional information is on the SARA website: <http://www.radio-astronomy.org/>.

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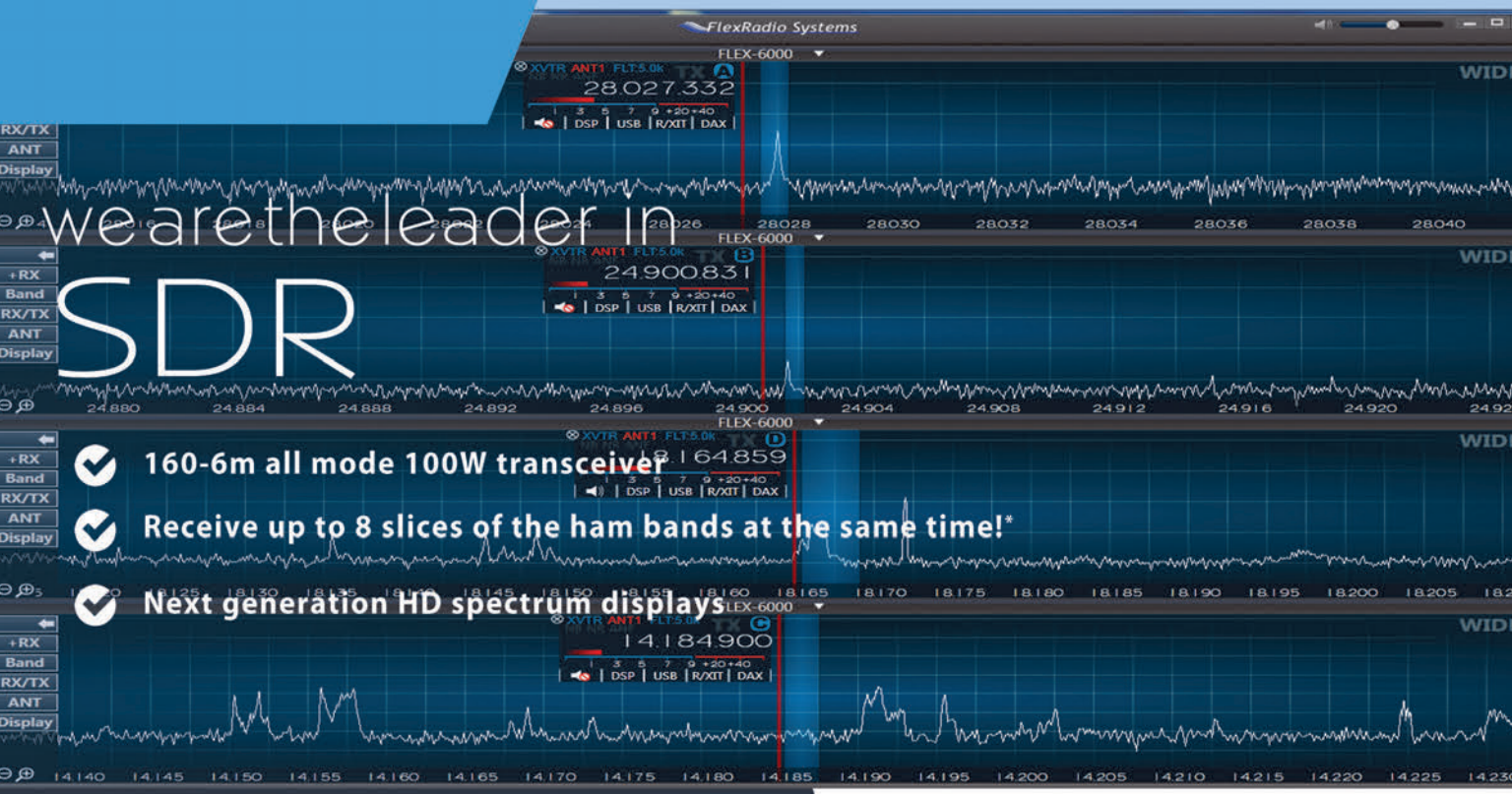

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Rover Redux 2013: The Evolution of a VHF Subculture

Being a rover has been tough over the past 20-plus years. There have been potholes and detours—all disguised as rules changes. Through everything some rover operators have persevered to today. Here K1DS briefly covers the rover's history.

By Rick Rosen,* K1DS/R

VHF contesting has been with us for decades. Over time, and when the sunspot cycle was not providing those great 6-meter E_s openings, someone had a good idea to increase multipliers by having stations operate in areas that were underpopulated by VHF operators. Two of the forces behind this included the Motorola Radio Club in Massachusetts and the Mount Greylock Expeditionary Force, W2SZ. Even before the Rover class was established, they had stations travel to ARRL sections (in pre-grid multiplier days) or grids that were rarely heard.

In June 1991, Rover and Multi-Limited categories were developed after a series of articles in the *NCJ* galvanized popular support for the creation of these new categories[1]. The rules were published in May 1991 *QST* and listed the Rover class as one or two operators of a single station that moves along two or more grid squares during the course of a contest. "All Rovers are encouraged to adopt operating practices that allow as many stations as possible to contact them."

Rover scoring was unique and the score was calculated using "the total number of QSO points from all bands times the number of multipliers from all grid squares in which they operated." There would be a plaque award for the top-scoring rover and a certificate for the top rover in each ARRL Division where significant effort or competition was evident.

Billy Lunt, KR1R, ARRL Contest Manager, and Warren Stankiewicz, NF1J, Assistant Contest Manager, wrote the *QST* article and stated:

> One of our goals in administering the VHF QSO parties and VHF Sweepstakes is to make them interesting and enjoyable so that participation will remain high. This requires periodic adjustments, as technology and times change. This year we added two categories to the ARRL June VHF QSO Party: Rover and Limited Multioperator. Good intentions are one thing, but the proof is in the pudding. Both categories proved extremely popular….Roving too suits participants—Rovers and non-Rovers alike.

Dean Lewis, WAØTKJ/R (now K9ZV), was the top rover scorer with 263,725 points on the basis of 473 contacts and 385 multipliers. He had been a rover long before this class was added to the ARRL activities. There were 50 Rover entries published in the *QST* results, with WA3UGP and KC1EB using 10 bands each.

In the September VHF QSO Party in 1991 there were 29 Rover logs submitted. By January 1992, there were now 79 Rover entries with many scoring more than 150,000 points under this quite liberal multiplier system. In the June 1992 report there were 66 Rover logs, and two teams of operators in the Central Division covered 14 and 15 grids each. The scores appear to correlate with both the number of bands operated and the number of grids covered. (That year, I was operating with the Providence Radio Association as a multi-op station from Block Island.) The September VHF QSO party now had 46 Rover entries.

Grid Circling and Evolving Rules

Fred Stefanik, N1DPM, and Stan Hilinski, KA1ZE, were driving to a regional VHF Conference together and they discussed the rules and scoring for rovers on their trip. They realized that with the option of having two rovers, well equipped with several bands, they could count unique grid multipliers each time they changed grid locations, and between the two vehicles could amass a mighty score.

On top of that plan, each of the vehicles would have a father-and-son licensed operator team, and the family rule would apply, allowing each contact to be doubled by passing the mike or key to the other family member. Stan called the League headquarters to ask about the legitimacy of this activity and the response was, "Nobody is going to do that."

There was a winter storm that battered the Northeast and many fixed stations had problems with their antennas, including Stan. So he went about assembling a 9-band station (50 MHz–10 GHz minus 5 GHz). The antennas were assembled on roof racks made of 2×4 frames and they also used simple coffee-can antennas for the microwaves.

The two rovers each went to two 4-corner grid intersections and did the rover dance around the grid corners. Although this would seem to be a simple thing to do, it is a bit tricky to do in the Northeast corridor due to the topography. The younger boys had a great time with this, trying to speak as quickly as they could to speed up the point-collecting process. The scores were 1,277,860 for KA1QAS, 1,269,637 for K1CPJ, 1,252,440 for NR1L, and 1,250,640 for KA1ZE. Each of them had over 900 QSOs and over 360 grid multipliers.

Although the bulk of their contacts were between the two family station rovers, they did manage to work many other members of their Hampden County Radio Club. On occasion during their runs with each other they were interrupted by anoth-

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This article originally appeared in the Proceedings of the 39th Annual Eastern VHF/UHF Conference. It appears here courtesy of the author.

Author disclaimer: The information contained in this paper is based on articles in QST, *web sites, interviews, and recollections of VHF contesting participants and may have some inaccuracies.*

er station trying to call them. They sometimes had to ignore that call in order to complete their runs and continue their rhythm.

All told there were 110 Rover entries in that contest. Roving was clearly gaining popularity and the scores were continuing to climb. The write-up in *QST* said the following:

In this year's VHF SS results, the big story is the success of several rover teams and the effects their scores had on the club aggregates. A four station group consisting of two father-and-son teams, KA1ZE and NR1L and K1CPJ and KA1QAS, respectively, *ran away* with the top four rover spots and provided a huge boost to the Hampden County RA's aggregate score.…Although their ingenuity led these four operators to new scoring levels, there's controversy in the VHF/UHF contest community as to whether the rules should be changed to discourage this kind of rover operation in the future."

The actual club aggregate score for the Hampden County club was 6,189,502 points, with the Rochester VHF Group scoring 2,568,944. Both topped the scores of the Packrats that year, which with their 57 entries had an aggregate of 2,056,420. This also marked the first time that there were four entries in the Unlimited Club class, needing 50 or more log entries.

There was then a request for feedback to the Contest Branch, followed by commentary on the value of roving, especially with use of the microwave bands, as the Rochester VHF Group pulled past the Mt. Airy VHF RC. This was the first time since 1961 that the Mount Airy VHF RC was not the top winner in the VHF SS club competition. The write-up went on to say that adding a rover to your club counts double, with points for both the fixed and rover station.

There was also the warning to be sure that the 175-mile radius was heeded. Paul Nerger, KF9EY, had his article "Roving for VHF Gold in the Colorado Rockies" published in the same edition of *QST* that had the January results. Articles such as this as well as the soapbox feedback were encouraging to other rovers and gave a reality check of what it was like to be on the road in the wilderness, in the scrutiny of park rangers and law enforcement officers as well as curious visitors. It also reflected the changing and often unexpected weather conditions on mountaintops and other unique geographies.

The June 1993 Rover category rules introduced another regulation that prohibited stations from combining their fixed and rover station points as a single entry. This also clarified the ability of a station to operate both a fixed and a rover station during the contests. This is an opportunity that is used by a few hams that have both a fixed station and another set of radios that can be used in the rover. Remember that you cannot use the same radios and antennas under two different calls during the contest, except for the family station rule.

By January of 1995, the Rover rules again were modified. This time there was a prohibition of the use of the family rule, and only one call could be used from a rover. They also changed the scoring so that a rover would submit separate scores for each grid square of operation and the final score would be the sum of the scores from each grid. No more aggregate multiplier.

This change in scoring was a huge disappointment for many of the rovers who were so keen to see scores in the 6-digit ranges. Some vowed never to rove again. But the rules were the same for all rovers. It would, however, change some of the strategy and tactics of various rovers, depending on which parts of the country they were operating. This substantial change in the scoring system also kept club scores from being astronomically inflated with the addition of a few grid-circling rover scores.

There were 70 rovers that submitted logs for the January VHF SS. The highest rover score submitted by WA2MOP under the new scoring system was a mere 81,000 points. Again the Rochester VHF group won the Unlimited Club competition, but the Packrats won the Medium Club category as they only had 46 log entries. In the June contest the highest rover score was 21,000 points by ND3F. Wayne Overbeck, N6NB, entered a rover log with a score of less than 10 points.

In the September contest, AA7VT turned in a 39,500 point score. This is also the first contest where I operated as a rover in the RI and MA grids, submitting a score of a few thousand points.

More New Rules

In the November 1995 *QST*, another set of rules changes for Rovers was announced based on a poll of rovers and other VHF operators and this was approved by both the ARRL Contest and the Awards committees. The new rules would take effect starting in January 1996. The objectives of the rules were to be simple to calculate scores, fair to all, progressive scoring over the course of the contest, and discourage "grid circling."

The following *QST* issue had a one-page invitation to the January VHF SS and a boxed synopsis of the new rover scoring rules that added all the QSO points and multiplied them by all of the grids worked during the contest, regardless of which grid they were made from, and also added one additional multiplier for each grid in which the rover made QSOs.

Photo 1. Bill Seabreeze, W3IY/R, operating on the shores of the Choptank River in FM18 near Cambridge, Maryland.

Glen Swanson, KB1GW (SK), had an article published in the January 1996 *QST* (p. 59) entitled, "It's Time to Explore VHF/UHF Contesting." In that article he pointed out that rovers are "contesters who pack their vehicles full of radios and operate from more than one grid square, and especially the rare grids for the benefit of other operators."

In the January 1996 VHF SS, there were over 70 rover entries, and Brian Skutt, ND3F, covered 16 grids and scored 126K points on the basis of 556 QSOs and 115 grid multipliers. Wayne Overbeck, N6NB, also submitted a log now with 47K points. The rover scoring seemed reasonable, and there was a bonus multiplier for crossing into a new grid and making even one QSO. Brian's comment was, "My plan to operate from 16 grids was flawed because I didn't 'work the bands dry' from each site." The average of the top ten rover scores was 47K.

Clearly the rules had proven to give a boost to the class with a reasonable scoring scheme. By June, even with the reduced point values per QSO, the top ten rover scores averaged 66K. The top rover, Brian, ND3F, had a 96K score. I managed to submit a 54K rover score. Once an amateur had attempted a rove, if the activity and the results were rewarding, it encouraged further effort. Add more bands, increase the power output, get bigger antennas and be able to raise them higher. Publish your rover route. Add another driver or operator to reduce fatigue and speed band passing while still keeping the running bands open.

The January 1997 VHF SS continued to see large numbers of rovers despite problematic weather conditions. Billy Lunt, KR1R, the ARRL Contest Manager then wrote in *QST*:

> Rovers are another entity that contributes to the overall fun of the contest.…With the lack of enhanced band conditions when nearby grid square multipliers are hard to come by, rovers offer us those much appreciated grid square multipliers, especially on the microwave bands.…Hats off to the rovers! Their presence and efforts don't go unrecognized.

Jack Nyiri, AB4CR, was the top-scoring rover with 143K. One remarkable feat by a rover was accomplished by KB6JVV, the daughter of John Kitchens, NS6X, who roved in 5 grids and used 16 bands including the letters from A to P except M. This was accomplished between the father and daughter team by use of 5 ft. dishes and a special signal generators and frequency counters for bands above 24 GHz in the Los Angeles area hilltops. John remained as the fixed station, and the story is reported as a sidebar in the June 1997 issue of *QST* (p. 106).

The June 1997 VHF QSO Party rules reiterated the restriction of the rover being used as a family station under two different call signs. This will be of interest as the application of this prohibition seemed to fade in a few more years. AB4CR/R with N4GN was top rover with 214K, passing through 14 grids with 11 bands, but seemingly tracked by K4EFD/R who had a similar band complement and the same 14 grid rove.

Photo 2. John D'Ausilio, W1RT/R, with Andy Zwirko, K1RA, during the September 2009 VHF QSO Party.

The January 1998 VHF SS rule 2.3.2 stated, "A rover may not operate with more than one call sign." There was no further verbiage regarding the application of the family station rule. When the 1998 June VHF QSO Party rules were published, there was a change in numbering of the rules and there was no explicit statement regarding the use of only one call by a rover station. The January 1998 VHF SS was remarkable for a new Rover record of 21 grids in operation, surpassing the record of 20 grids set earlier by NØLRJ/R. The team of Tim Marek, K7XC, and Ward Wheaton, WB7VVD (now K7PO), scored 107K on that outing, making 674 contacts with 114 multipliers using bands ABCDE. The June results again showed AB4CR/R +KF4TUK as the top rover score with 255K and 12 grids roved. N4STK also had a 13 grid rove with the same 11 bands. What were their tactics?

Newer Rules, New Records

In January 1999, there was a new rover scoring record set under the new scoring rules. Operating under the call of N3IQ/R, operators Brian, ND3F, and Terry Price, WD8ISK (later K8ISK and then W8ZN), posted a score of 1,391,942. They used 12 bands and had a tandem rover, K8GP/R operated by Owen Wormser, K6LEW (now K3CB), and Joel Knoblock, KA3QPG (now W3RFC), who posted a score of 827,372 points. N3IQ/R activated 14 grid squares; K8GP/R activated 12 grids. They usually worked each other on 11 bands—and then set out to work everyone else they could hear or raise in the VHF-station-dense northeast corridor. Gene Zimmerman, W3ZZ (SK), reviewed the log afterward and noted that the team worked 35 different stations at least 20 times in the contest.

N3IQ also had four laser QSOs for a 12th band. The N3IQ/R station towed a generator that powered KWs on the lower four bands, with short antennas rotatable while driving. Brian did most of the operating; Terry did most of the driving. A big challenge for the operator was sitting backwards (facing the back of the van) for long periods of time. They lost their microwave preamps at one of the first sites in New England, probably from operating too close together, possibly limiting the score somewhat!

There was a "random" breakfast meeting of several rovers on Sunday morning. W3IKE/WAØQII/R (SK), N3KTV/R, W3EKT/R, along with Brian, Terry, Joel, and Owen and others—about 10 rover operators all together—met near the FM18/FM19/FM28/FM29 grid corner. They enjoyed coffee and doughnuts, and worked each other a few times, too.

Brian described it as really fun—despite having to repair the generator on the fly, getting rain into the 222-KW tube amp (big pops while driving on I-287!), getting rear-ended by a drunk driver in Delaware, and almost falling asleep at the switch on Sunday night. They actually quit about 10 PM due to fatigue.

The June 1999 VHF QSO Party continued to demonstrate increasing rover activity and higher scores. From the numbers of contacts, grids operated, and bands used, it appears that many of the highest scoring rovers continued to do some grid circling or partner-roving with a similarly equipped rover.

The January 2000 VHF SS rolled around and my son Leon Rosen, N1XKT, was now living back home with us in Pennsylvania, where we had moved in 1997. I wrote to Dan Henderson, N1ND, the ARRL Contest Manager, and asked if the rover could be considered a family station. He answered that it could, and there did not appear to be any specific current prohibition in the published rules at that time. Currently the following information is on the ARRL website for the contest rules for VHF:

2.5.1. A rover vehicle may transport only one station using a single call sign. An exception is provided for in "General Rules for All ARRL Contests" number 3.5 (Family Rule). 3.5. A transmitter used to contact one or more stations may not be subsequently used under any other call during the contest period, except for family stations where more than one call has been issued, and then only if the second call sign is used by a different operator. (The intent of this rule is to accommodate family members who must share a rig and to prohibit manufactured or artificial contacts.)

Since that time there have been many family rovers, including a three-generation rover of David All, N3XUD, his daughter Angel, KB3STA, and Bill All, N3KKM, now a Silent Key. In 2000, Leon and I both went out in the aging station wagon, with bands A through I and P, minus 5 GHz. We roved in two local grids, using the stop-and-shoot method, and had fun garnering 9K and 8K, respectively. Leon had more QSOs and grids as

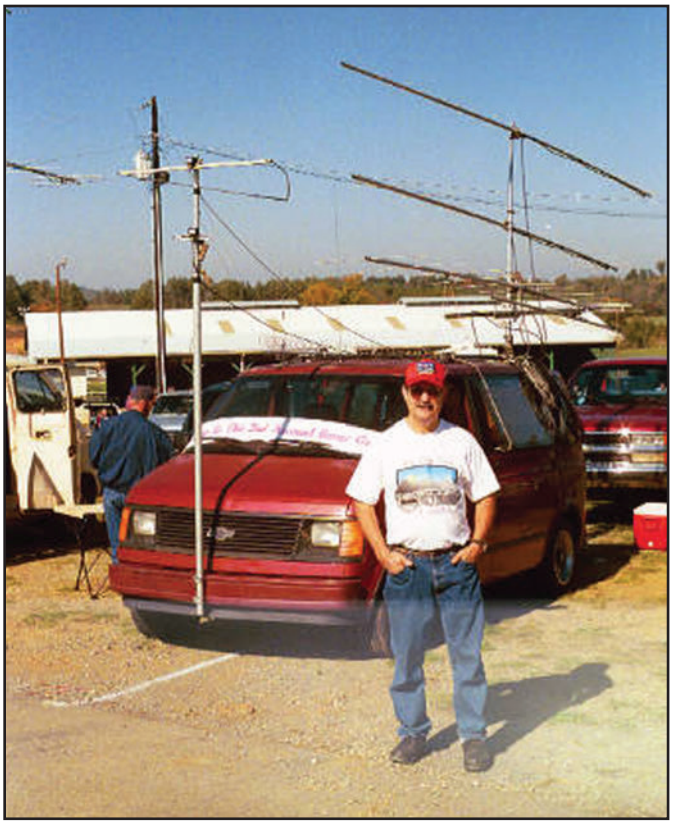

Photo 3. Mike Weschler, N4OFA, and his "Red Rover." (N4OFA photo)

Photo 4. Brian "The Rover" Skutt, ND3F/R, with his converted ambulance.

he was able to operate using the whip mag-mounts while I drove. Our picture appeared in the *QST* write-up, and I sure remember how cold it was doing a stop-and-shoot operation in January. I vowed that I would design a rover that would not require going out of the vehicle for more than a short few minutes.

There was also a developing body of knowledge about roving and much was being shared at regional VHF conferences, over the internet, and in various publications. From a review of the *QST* rover listings in the VHF contests, there are some perennial rovers, such as Russ, VE3OIL, and his partner Murray, VE3NPB (20+ years), and then others who shined brightly for several years and then went on to other phases of VHF. By 2001 the number of rovers represented in the contest was stabilized between 60–100, depending on the season and weather.

This would be the year that Bill Seabreeze, W3IY (SK), shows up in the Rover category and operated together with Brian, ND3F, in June, covering 12 grids and coming in first place (see photo 1). In the September contest we also see Christophe, ON4CFX/W4, operating as a rover. I remember contacting him and being very excited to hear that unusual call, and even more excited to have a new grid, FM09, in my log. Christophe would later change his call to ON4IY and become a regular roving partner with Bill, W3IY. When Bill passed on and his rover, "The Intergalactic Jitney," was sold to John D'Ausilio, W1RT, Christophe would partner with John for roving (see photo 2).

Hams were adding names to their rover vehicles. Mike Wechsler, N4OFA's "Red Rover" showed up at several southern hamfests (see photo 3). The "Psycho Rover" from N2JMH made a great YouTube video: <http://www.youtube.com/watch?v=YwngvV-tilw>. I dubbed my recently purchased used 1994 Ford van "The Great White." Scores of the top rover entries were in the 100–300K range. Fixed stations were happy to track the progress of the rovers and try to work them in as many grids as possible, especially if they had the high-point bands of the microwaves.

Many of the rover stations were adding microwave bands as this improved not only their score, but their popularity among the bigger multiband operators. There were also mini-rover conventions during a contest, when several rovers would converge on one particular popular high location, and then a flurry of contacts would take place, each rover benefitting from a significant number of contacts, especially on the higher point bands.

Brian Skutt, ND3F, bought an ambulance that had been taken out of service and converted it for roving with a crank-up tilt-over tower (see photo 4). He spent considerable time removing the ambulance red and blinking lighting to make the vehicle road-ready. Sadly the vehicle did not last more than a few outings.

There were discussions on the internet contest reflectors regarding the best rover antennas and schemes for stacking. Ideas were shared regarding the most efficient ways to maximize operating time, minimize driving and set-up times. Mark Herson, N2MH, "The Lighthouse Rover" (see photo 5), published a website <http://www.n2mh.net/rovesite. htm> that identified useful rover operating locations. The site links to several mapping programs that show the grid, latitude and longitude, roads, topography, and satellite views.

There were also user notes along with the compass headings to some of the larger fixed stations. I personally make significant use of this website in addition to compiling the routes and roving locations used by many others. This has been an out-

standing resource, and also includes the N2MH rover routes up through 2007.

Ev Tupis, W2EV, suggested the use of APRS for the rovers. However, this was considered a "self-spotting" tactic. It proved to be not acceptable to the contest rules, as noted in the "The World Above 50 MHz" column written by Gene Zimmerman, W3ZZ (SK, see photo 6), in his column in the January 2003 *QST*:

APRS in ARRL VHF/UHF/SHF Events: There still appears to be some confusion about the legality of using APRS to track stations in ARRL VHF/UHF/SHF operating events. This in spite of what I thought were clear statements from ARRL Contest Branch Manager Dan Henderson, N1ND, on various VHF oriented Internet reflectors. For the record, Dan says,

The purpose of APRS is to announce report and track a station's location. The use of APRS during an ARRL contest is considered self-spotting which is a violation of Rule 3.14 of the General Rules for all ARRL Contests, which reads: "In contests where spotting nets are permissible, spotting your own station or requesting another station to spot you is not permitted."

So the use of APRS as a tracking aid is not legal for any class of operation, single-op, multi-op or whatever.

This rule would also be modified in the future.

Photo 5. Mark Herson, N2MH/R, the "Lighthouse Rover." All antennas are homebrew. (N2MH photo)

Transitioning to Online Results Reporting and Years of Controversy

In 2002, there were no longer complete listings of the results of the entries in *QST*. The top scoring stations were listed by category and the rest of the results were posted on the ARRL website. This raised a ruckus with the contesting community. Everyone liked to see their call listed in the results or soapbox. But the ARRL and the *QST* publication needed to become more cost efficient, and the contest results listings were sacrificed. For a few years after, there continued to be rumblings. Now in 2013, we have accepted the fact and are able to make use of the on-line archives, sortable contest results and contest records on the ARRL website.

During the year, Wayne Overbeck, N6NB, made a trip east and purchased a 4×4 vehicle and outfitted it with a few radios. He came to Camelback Mountain during a contest while I was operating and watched as I operated my rover, making QSOs on bands through 10 GHz and LASER.

I gave him a spare LASER communicator and together we made a few QSOs as we traveled through FN21, FN11 and FN10. Another time he set himself up in FN20 at the Alamuchy site off Rte 80 with a newly purchased 5 GHz transverter from DEMI and made a QSO with me while I was on Camelback.

Photo 6. Gene Zimmerman, W3ZZ (SK), longtime "The World Above 50 MHz" columnist for QST.

He was shocked that the signals were 20+ dB/S9! I made a video recording from my end and he later drove up to see it and was amazed at the quality of the signals on that band—it was about a 40 mile line-of-sight contact. He was further stimulated to enhance his rover capabilities.

In 2003 we had some unique developments. The top January rover score was by N2JMH/R with 525K points! He was followed by K2TER/R with 473K. The average score of the top ten rovers in this event was 272K, likely due to the combination of grid circling, pack roving and a nice 3-hour 6-meter sporadic-*E* opening.

The Rochester VHF group was the top club in the Medium category with 3.3 million points and 44 log entries. This was accomplished with two large multi-op scores and five big rover scores in addition to their other 37 entries.

Wayne, N6NB/R, returned in January of 2003 with a Ford E350 Supervan to further test his roving skills. He traveled over 6,500 miles round-trip to make this pilgrimage, back to the heart of East Coast density of VHF ham operation. It was also a sentimental journey—N6NB/1 on Mt. Equinox, VT, set national scoring records in the June and September VHF contests as a single operator in 1979–1980 with his cab-over kilowatt mobile station.

In the April 2003 issue of *QST* (p. 86-88), Gene, W3ZZ, published an article entitled, "VHF Contests Reexamined: Changes in the Wind." He expressed his thoughts concerning the gradual reduction of the number of submitted logs from 1993–2002 in almost all of the VHF and up ARRL events (10 GHz saw an increase) and the gradual decline of the top and average scores from 1997–2002.

These issues were brought to the Member Services Committee and the ARRL Board. Gene could not point to any clear reason for the changes. He was concerned that despite an increase in Rovers and their ability to make multiple contacts with the same stations and the wider availability of radios capable on at least bands AB&D that there was some sort of ennui affecting the ham participation. He set out several points for consideration including this regarding rovers: "*Return to the original rover scoring rules*—One very promising development over the last decade is the appearance of rovers who travel from grid to grid. Changes were made in the original rover rules to fix a problem in club competition. The present rules, for strategic reasons, strongly inhibit rovers from visiting rare squares particularly if they are isolated and in odd directions from population centers.

"One obvious solution is to return to the original rover scoring rules, but do not allow rovers to submit scores for clubs, so their scores will not distort club competition. If a club is a real VHF club and has many active members, each one of their scores will benefit immensely from the operation of even a single rover in club territory. Thus, the rover is a benefit to a club but is permitted to travel freely from grid to grid without being constrained by the scoring rules."

The 2003 June VHF QSO Party was hopping with 93 rover logs submitted. Bill, W3IY/R, with his roving partner Christophe, now ON4IY, roved many coastal and Shenandoah mountain grids to amass 270K points. Brian "The Rover" ND3F/R also had a great activity, but was unable to submit a complete log as he had one disastrous computer glitch.

On the West Coast, N6TEB/R (KG6EPM opr), was in second place with 230K points, and in sixth place was Wayne, N6NB/R, with 116K. By September, Wayne was putting together more multiband rovers and he turned in a score of 360K to top the list. Six of the top ten rover scores were posted from California. Bill's W3IY/R jitney managed only third place despite a 306K score.

The 2004 January VHF SS showed Wayne, N6NB/R, making his way up the score list, with three rover stations that he engineered, each breaking the 1-million point mark and taking the top three spots. Wayne's score of 1.097 million fell short of Brian's mark of 1.39 million, and that would be the next target for the Southern California Contest team.

With the rovers travelling together doing both pack-roving and grid-circling at relatively close range, there is not a great need for high power or large antennas. Attention needs to be paid to the remote switching of the IF rig to the transverter. The project eventually multiplied into 12 such rover stations, including the addition of 24 GHz to some.

In "The World Above 50 MHz" column in May 2004 *QST* (p. 84-85), Gene, W3ZZ, wrote about the decline in the number of logs submitted for the VHF contests and various ideas that might promote greater participation and log submission. He again decried the practices of grid circling by rovers and the captive rover exploits. The possibility of a return to the original rover scoring rules was suggested, with rover-to-rover contacts within the same or adjacent grids limited to 1 point each, or the practice of grid-circling banned. At the same time in the May 2004 *NCJ* (p. 28), Wayne, N6NB, wrote "Roving in VHF Contests: How to Score Three Million Points—And Why."

The June 2004 VHF QSO Party again showed the California team of three rovers in the win, place, and show spots with between 1.292- and 1.131-million points each by roving through 20 grid squares in West Texas, Oklahoma, Kansas, and Nebraska. Continued suggestions and feedback on the scoring, rules, and participation encouragement were made by contesters as well as the various ARRL committee members. In the September VHF QSO Party the W3IY/R team of Bill and Christophe made their mark with 382K points and had no competition from the California rovers.

The January 2005 VHF SS saw the California rover team setting another record with a rove through 22 grids in west Texas and New Mexico. The three teams scored between 2.202- and 2.153-million points each by pack roving and grid circling. The June VHF QSO Party had Dave, N6TEB/R, as the overall winner, with Bill and Christophe operating W3IY/R in second place. This would be Bill's last rove, as he became a Silent Key at the end of the summer. His legacy is marked with his website maintained as a resource page for rovers by John D'Ausilio, W1RT/R at: <http://www.w1rt.us/w3iy/index.html>.

The "Rover Recognition Award" was also established in his memory by the Mt. Airy VHF Radio Club. This award has been given annually since 2006 to a rover station that demonstrates particular excellence throughout the year. Consideration is given to the effort, regularity of operation, bands operated, grids covered, and contribution to the VHF community, unique factors, and operating characteristics. The September VHF QSO Party that year had Russ, VE3OIL/R, and Murray, VE3NPB, in the number one rover spot.

In 2006 and 2007, there was an increase in the number of Southern California 10-band equipped rovers and in most of the contests they dominated the winning positions. My comment in the June VHF QSO Party write-up in *QST* of Single-op and Multi-op stations analyzed the impact of rover contacts and they accounted for 20–35% of their total scores. In the case of the SCCC rovers, spending most of their time focusing on each other and per-

Photo 7. Carrie Tai, W6TAI, and her 6-band microwave toolbox.

haps a few selected fixed stations, they could set up to capture top honors in selected classes. They used this strategy in several subsequent events.

APRS and Rovers

Rules changed in 2008 for rovers. Rovers were now allowed to use APRS providing call and location in Beacon Mode only. Use of APRS information through digipeaters and/or the internet was limited to multi-operator stations (LM, UM, Rover) as per the general contesting rules. All Rover classes could use HamIM.

There were three classes delineated: the rover (classic) with 1 or 2 operators and unlimited bands; the limited rover, again 1–2 operators and using 4 bands of their choice and having a low output power restriction; the unlimited rover allowing any number of operators and with no restriction to carry all their equipment and antennas. The rover and limited rover could participate in club aggregate scores as long as operation was within the 175-mile radius of the club. Those classes were also limited to 100 QSOs with any other rover.

Unlimited rovers could not participate in club aggregate scores and had no limits on rover-to-rover QSOs. Since this time and rule change, the group of Southern California Contest Club rovers has not done any grid-circling. They have continued to use their stations to follow the rules and contact limitations, moving the group from grid to grid to maximize their opportunities for both contacts and multipliers.

In his "The World Above 50 MHz" *QST* column in March of 2008 (p. 89), Gene, W3ZZ, commented that these changes would appear to deal with the grid-circling and pack-roving issues and increase rover participation with the wider availability of transceivers that covered several of the VHF/UHF bands.

Steve Clifford, K4GUN, wrote a nice article in the 2008 October issue of *QST* (p. 48–50) outlining his learning experience as a first-time Limited Rover. How would the new rules affect rovers and what would the results show? In the first outing in January 2008 under the new rules, there were 34 Rover entries, 24 Limited Rover entries, and only 1 Unlimited Rover entry, whose score of 17K points was unremarkable. In the June event that year, it appeared that there was still a group of rovers that worked together, under the limits of the rules, and won the top honors in Rover, Limited Rover, and Unlimited Rover categories.

There was only a total of eight entries in the UR class. It is especially notable that KG6TOA/R used four top bands, from 2.3 through 10 GHz, and crossed 15 grids, staying under the limit of 100 QSOs with any other single rover, and scored 97K points to win the category. The next highest LR score was 36K. Noting this scoring aberration, the rules would again soon change for this rover class.

In the September VHF QSO Party there were only three entries in the UR class, and there did not appear to be a clear distinction as to why the station was in this class, as many of the rovers did not have multiple operators, nor did they appear to make more than 100 QSOs with another single rover. It appeared that a station could simply declare itself as an Unlimited Rover to get into a smaller competition pool.

In January 2009, the California rovers continued their tactics to dominate the top places in all three rover categories. The ARRL announced in the August edition of *QST* that the Limited Rover category would only include the lowest four bands for the contests—that would be bands ABCD (50–432 MHz) and for the UHF Contest bands CD9&E (222–1296 MHz).

Those rules were actually in effect for the June VHF QSO Party and it did not make a significant change in the number of entries in that category nor a significant difference in the overall scores. There was, however, an absence of the California team rovers in the submitted logs and there was some concern that the series of constructed VHF and microwave rover stations were languishing in disuse. This thought was put to rest as the September VHF QSO Party showed those rovers back in action and taking the top five spots in the Rover category.

Adding to their list of top honors, the Southern California Contest Club had their rovers scoring in the 500K point range in the January 2010 VHF SS which led them to a first place in the Medium Club competition with an aggregate of over 5-million points from 12 logs. These scores and tactics continued to distort the field of competition.

In the June activity they had a group of 15 operators in 10 vehicles and fixed multi-operator and single-operator stations. Each vehicle had 10 bands with three also equipped for 24 GHz. The design of the rover stations was cleverly done, with the microwave transverters all mounted in a toolbox and the antenna stack mounted atop the toolbox. The entire package was then mounted to a rotator which is fixed to the vehicle. Among them was Carrie Tai, W6TAI. See photo 7.

This arrangement has several advantages for the rover. It keeps the feed lines to the antennas very short, aligns all the antennas simultaneously, and allows the package to be fitted to any suitable vehicle without drilling any holes in the metal. Nine of the vehicles entered the Rover category and they won the top eight spots nationally with scores from 224–299K.

Murray Hill, VE3NPB, and Russ Beech, VE3OIL, came in ninth with their score of 120K. They have been a team for almost

20 years of roving, switching off and using each other's call signs for the different contests.

In this outing, Brian, ND3F, and David, N3XUD, teamed up and operated in the Unlimited Rover category to score 180K points and lead the group of 10 entries. The September QSO Party had a similar rover story with the SCCC rover group taking the top eight places with scores in the 200K bracket. This time N6NB entered as a QRP station, from a nicely positioned mountaintop location. He was able to break the scoring record for this category with 266K points, supported by working all the pack rovers with hundreds of QSOs.

In January 2011 there was more of the same rover activity from the usual players, with the SCCC copping all the top spots in all three Rover categories. This time John Kalenowsky, K9JK, joined forces with John Desloge, N6MU, to take the first place Rover position, working with the pack or team rovers in the west. June's rover standings were slightly different, but the same group of SCCC rovers was leading the scoring again in their categories.

In September the SCCC group was not on the air. Wayne, N6NB, was on his way to New England to rove with his new trailer setup and tower when he received a call about the canyon fire on September 4th that destroyed the mountaintop cabin and all the station contents. He aborted the trip east and returned to California to manage the losses.

John D'Ausilio, W1RT/R, with Andy Zwirko, K1RA, placed first in the rover category with 245K points. The VE3OIL/R team was second with 119K. In the LM category, K2QO/R scored top honors with almost 66K. The NN3Q/R team was tops in the RU category with 52K. This seems to illustrate the unique nature of the density of VHF/UHF contacts in the east coast corridor between Maine and the Carolinas. In order to compete on the west coast, they had to initiate a strategy and tactics to make scores that would beat the east coast rovers.

In ongoing attempts at record setting, the SCCC group teamed up with the Nacogdoches (a small town in east Texas) ARC in January of 2012. They had at least eight well-equipped rovers doing their dance in addition to working the mother ship, this time K5QE. They took all the top rover spots with scores between 184–379K, and the K5QE MU station won their category with 812K points.

In addition the Nacogdoches ARC won the Medium club gavel with 3-million points from 15 logs. The adventures of the SCCC rovers continued in June for the VHF Contest and in August for the UHF

Photo 8: Wayne Overbeck, N6NB's Tower Trailer rover parked at the 2012 Mid-Atlantic VHF Conference.

Contest. In each of these activities their rovers took the top several places. In January of 2013, Wayne, N6NB, and Carrie Tai, W6TAI, joined in a rove back with the East Texas group using their newly assembled tower trailer (see photo 8). With the tower's height advantage of about 50 feet when fully extended, they were able to make contacts through 10 GHz from multiple grids.

Several large multi-op stations make use of rovers to enhance their scores. I like to call these "dedicated rovers," whose first goal is to contact the mother ship from each grid, and then, time permitting, try to make additional QSOs with other stations. For several decades, the W2SZ Mount Greylock Expeditionary Force has had almost a dozen rovers traversing grids in the northeastern US to provide contacts and multipliers from grids that otherwise have little or no activity, especially on the microwave bands.

Although they are technically not true captive rovers, as they can and have made QSOs with other stations, the way that many of them are equipped makes it near impossible to have QSOs with them on the higher frequencies. This unusual situation is due to the way that the rovers were originally equipped, using a unique IF for the microwave bands which allows them to contact the mother station on unique frequencies with very limited power. Each of the rovers has a route with detailed maps and a system of timed transmissions for microwave QSOs in 15-minute blocks.

Although it is rather easy to make a contact with W2SZ on bands ABCD, scheduling a contact with them on the higher bands is often difficult and generally waits until the end of the contest when they have finished working all of their rovers. Apparently this strategy has been very effective for them, as they have been consistent winners of the MU category for decades. There have been exceptions, though, when other MU stations have adopted similar strategies and beat out W2SZ for top honors in that category.

Pack-Roving

Controversy continues regarding the practice of pack-roving. With the rules change, the practice of grid-circling has essentially been eliminated. There is no question that the technique yields high scores and helps to win certificates, plaques, and gavels. Planning routes and coordination of communication between large groups of rovers is a complex process. Rehearsing the activity is also valuable to assure efficiency of time. Hams who were not previously engaged in VHF activity have been stimulated by these activities.

There have been created small communities to support these group activities, but they have had no significant impact on global contest participation. They do not adhere to the statement, "All Rovers are encouraged to adopt operating practices that allow as many stations as possible to contact them."

The enjoyment of roving and completion of an active day of communication with multiple other stations is still quite satisfying. As a rover myself for almost 20 years, operating in the ARRL January VHF SS, during the spring and fall sprints, the ARRL June and September VHF QSO Parties (now called contests), the July CQ WW VHF Contest, the ARRL August UHF Contest, and the 10 GHz and Up weekends, I find it both fun and exciting.

Just like Forrest Gump: My Momma always said, "Life is like a box of chocolates. You never know what you're gonna get." Rovers have experienced all types of weather conditions, especially in higher locations. Some have encountered problematic road conditions, emergen-

cies where their radio communications came in handy, and multiple stops from law enforcement officers, eager to assure the safety of the community and country from potential problems.

Over the years there have been dozens of articles in *QST* and other amateur radio publications describing the construction of rover vehicle radio setups and antennas, operating suggestions, and locations. There are multiple websites with information on rover power sources, checklists of needed tools, spares, and emergency gear.

Rovers come in all sizes and shapes—from motorcyclists or even bicyclists to automobiles, SUVs, motor homes, and buses. Although there are usually 60–110 rovers logs submitted for each of the ARRL events, there are usually more rover stations out on the roads and hilltops making QSOs. Although this article has focused on a limited number of top-scoring rovers, there are dozens of hams who have been roving on a regular basis.

Whether they operate with one band or more than 10, rove in 2 grids or 22, they have added a dimension to VHF contesting and activity in general. They have provided a new avenue for hams who are stymied by location or deed restrictions to be able to be adventuresome and compete. They have encouraged greater diversity in contesting, and new competitive angles for scoring. They have facilitated others achieving their VUCC goals. They have even spawned the "Reverse VUCC Award" sponsored by the Central States VHF Society. The award is very similar to the ARRL's VUCC, but rather than contact a set number of grids on a frequency band, the goal is to make contacts *from* a set number of grids per band. The number of grids coincides with the ARRL award. See <http://www.csvhfs.org/CSVHFVUC.html> for details.

Why Hams Become Rovers

There appear to be many reasons why hams become rovers, and there is no one common theme among them, except perhaps for a spirit of adventure. I did enjoy multi-operator outings for many years with good clear and high locations. Over time these locations became unusable, usually due to access permission issues. It also became increasingly difficult to haul large amounts of radio gear and antennas and feedline, set up, and tear down over a single weekend. I operated from home for a few contests.

My personal reason initially for becoming a rover was that I lived in a suboptimal location for VHF communication, and I wanted to get more activity, having been spoiled by my multi-op experiences. My first roves were done in the family station wagon, using a shoot-and-scoot technique in 2–4 grids in the southeast Massachusetts and Rhode Island grids.

When I moved to Pennsylvania, I bought a home in a CCR restricted community that prohibited outdoor antennas (except for small satellite TV dishes). Having had the rover experience in RI, I thought that I could continue my activities on VHF as a rover. After one or two outings using the shoot-and-scoot, I realized that I wanted a setup that had minimal setup time and that would keep me warm in winter and cool in summer. When a used 1994 Ford 150 van became available, I purchased it and converted it into the rover I have used for the past 10 years.

As a Packrat, I realized that I could contribute significantly to the club aggregate scores for the various contests, and my routes have generally been planned to optimize the use of the microwave higher point per contact bands. When the club score

analysis is completed, the effort appears to be very worthwhile, not only for my own scores, but for those of the other club members who are capable of working me on 10 bands from multiple grids. On occasion I have had the pleasure of another club rover similarly equipped travelling close by.

We have taken advantage of completing some runs of the bands when we are in the same or adjoining grids. Although this certainly pumps up the scores, the excitement is still in adding some distant grids or finding some alternate propagation modes and making as many contacts as I can in all directions and with all responders to my CQs.

For many years I have given feedback to the VHF Advisory Committee regarding the rover class as one or two operators. Most often as a solo rover, doing all the preparation, route planning, driving, and operating, I feel somewhat disadvantaged to the two-operator teams who can be operating on multiple bands simultaneously.

One person can continually be on 6 meters if it is open, while the other searches or calls on 2 meters and then runs the bands with callers. In other situations, when 6 meters is not open, one operator can continually be on 2 meters and then hand off the contacts to the other op to run up the bands. These rovers have also designated a specific calling frequency on 2 meters in order to have other contesters find them more easily. Perhaps it's time for me to reconfigure my station for 2-meter operators and find a roving partner.

As many have recognized, there is not a level playing field in amateur radio contesting. When it comes to DX contesting, coastal stations are at an advantage. When it comes to VHF contesting, population density and topography are major factors in scoring. Aurora favors the stations toward the north. Sporadic-*E* and TE propagation are fickle and can play their tricks in any part of the world. In an attempt to win contests, there have been many groups and individuals who have made serious financial investments in land, towers, antennas, and radios that will facilitate their efforts. The same with rovers: Wayne, N6NB, has travelled east many times to compete in the ARRL events because he recognizes some of the advantages of contesting in the Boston-DC corridor.

Wayne and the SCCC group have also made a significant investment in gear, organization, and travel in order to accomplish what they have done in different geographies with different VHF operator densities. Yes, different strokes for different folks. All rovers have found some reason to get out on the roads. Most fixed stations are happy to work them, adding points and fun to contesting.

The ARRL VHF and Contest committees have been aware of the issues involved with the extremes of operations and have continually made changes to the rules to attempt to encourage increased participation and fair scoring schemes. As we move forward we will continue to be rationale and respectful of everyone's efforts to enjoy VHF contesting.

References

1. "The Past, Present and Future of VHF Contesting" *QST,* Oct. 2009 p. 80-83 Kevin Kaufhold W9GKA

Websites

Additional useful websites for Rovers:
http://www.k0nr.com/rwitte/rover.html
http://groups.yahoo.com/group/vhfrovers/
http://www.qsl.net/n9rla/

So You Want to Be a Rover

KØNR's article is about getting started as a rover in VHF contests, with emphasis on operating in or around the western U. S. Maybe you have thought about trying some rover operation but were not sure how to get started. This article can help you do so.

By Bob Witte,* KØNR

Rover operation can be as simple or as sophisticated as you would like it to be, and it is always a lot of fun. Operating rover is often just a good excuse to load up the radio gear and head out on a ham radio road trip.

Photo 1. A typical run-and-gun operation. (Photo courtesy the author)

The Rules

Step one in understanding rover operation for contests and other activities is to read the rules carefully to understand the those specific to rovers. Information on the ARRL VHF Contests in June, September, and January is at <http://www.arrl.org/contests/>. The CQ World-Wide VHF Contest rules are available at <http://www.cq-amateur-radio.com>.

I will not cover the specific rules for each contest here except to say that the basic concept is that rovers are allowed and encouraged to move from grid to grid, making contacts with stations multiple times. This type of operation is extremely valuable here in the western half of the U.S. because many grids are not occupied by fixed VHF stations. Because of the ongoing popularity of the VUCC Award program (see <http://www.arrl.org/vucc>), and the increasing popularity of the Fred Fish Memorial Award (FFMA, see <http://www.arrl.org/ ffma>), activating the rarer grids in this part of the country often helps fill in holes in the awards chasers' maps.

Concerning the Summits on the Air (SOTA) activations, in my "FM" column elsewhere in this issue and in the Spring 2013 issue of *CQ VHF* magazine, I wrote about that type of mountaintop operating. Although it is important to note that while being a rover can get you on top of certain summits, the SOTA rules concerning the final access to the summit state that it must be non-motorized and are pretty specific about the extreme portability of the operation.

Therefore, it is not likely that your rover operation will qualify under those rules. More information on the SOTA rules can be found at this website: <http://www.sota.org.uk/docs/SOTA-General-Rules-1.16.pdf>.

Equipment

The first question that comes up is "What equipment do I need?" Again, this will vary greatly depending on how much time, money, and energy you want to put into rover operation. I will focus on getting started and you can go from there.

The minimum capability for rover operation is 2 meters SSB capability with a horizontally polarized antenna. Obviously, this station needs to be portable so that you can move from grid to grid. While you may want FM capability along with you, the vast majority of operation will be on SSB.

Do not rely on a vertical antenna to operate SSB, because all serious contest stations will be horizontally polarized. Using the wrong polarization will cost you 20 dB or more in signal loss. There are a number of omnidirectional, horizontally polarized antennas for mobile use such as the Halo, SQLOOP, HO, Big Wheel, etc. You can mount these antennas on your vehicle and operate while in motion.

Another alternative is to use a small Yagi antenna (again, horizontally polarized). This will require a more advanced mounting scheme and may require you to "stop and point" to operate. Of course, a

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Yagi has a significant gain advantage over omnidirectional antennas. Even though the coax runs are short, use low-loss line such as 9913 or (at least) RG-8. In recent years, various dealers have been offering "Flex 9913," which has the low loss of 9913 but with a stranded center conductor for good mechanical flexibility, which is great for rover operation.

Basic Operating Approaches

There are two basic approaches to rover operation: "Run-and-Gun" and "Stop-and-Shoot."

Run-and-Gun means that you make contacts while in motion. This requires some careful thought as to how to point antennas (if they are directional), perform logging, and not get into a traffic accident. Photo 1 shows a typical run-and-gun operation. Also, Steve Hicks, N5AC, has equipped his truck for very sophisticated run-and-gun operation (see photo 2).

Stop-and-Shoot means that you stop and set up antennas at an appropriate location and operate from there. Many stop-and-shoot operators also have the ability to at least listen on 2 meters while in motion so they can stay in tune with contest activity. Stop-and-shoot stations need to be quick to set up and tear down so that minimum time is lost between locations.

Most beginner rovers will choose stop-and-shoot, as it is inherently less difficult. Photo 3 shows a typical stop-and-shoot operation. Steve, N5AC, can also make a good effort at stop-and-shoot; photo 4 shows his microwave setup. Wayne Overbeck, N6NB, is an example of a serious stop-and-shoot operator. Photo 5 shows his trailer tower operation.

Additional Frequency Bands

After you have the basic 2-meter SSB station covered, you can expand your station via additional frequency bands and increased station performance. There is no "single band" contest category for rovers, so adding additional bands is an important way to improve your score, your competitiveness, and your operating fun.

Six meters is probably the most important band to add to your rover operation, because this band is most likely to have propagation to distant grids. When 6 meters is open, you will want to focus your operating on this band to quickly gain contacts and grids.

Antennas for 6 meters are more of a challenge, because even a 3-element beam is quite large for mobile operation. Most operators tend to choose a small omnidirectional antenna. Sometimes I have used a vertical on 6 meters, which does well on long-distance propagation but suffers in local communication due to the same polarization loss I describe above for 2 meters.

Because of its popularity, the next band to add is probably 70 cm (432 MHz). Owing to their popularity, additional bands to add are 1.2 GHz and 222 MHz, in that order. Check out the ARRL contest rules to understand the increased points per contact for the higher bands. It is helpful (but not necessary) to monitor multiple bands simultaneously so that you don't miss an opportunity on one band while making contacts on another.

Station Performance

Improved antennas are probably the first place to look for increased station performance. Rovers tend to operate with marginal antennas (at least compared to the big-gun fixed stations). Increased antenna gain or height benefits both transmit and receive performance. Even a small Yagi has several dB of advantage over an omnidirectional antenna. Antenna height is important, so many rovers develop mast systems that allow their antennas to get high off the ground (20 to 30 feet), thereby improving their station performance.

Antenna Mounting

Mounting of antennas is a great challenge for rover operation, especially for run-and-gun. I will not go into detail here, but antenna mounting schemes that I have used include:

Drive-on Mast Mount: The basic idea is to mount a mast on a flat board, which is held in place by driving your vehicle onto

Photo 2. Steve Hicks, N5AC, is equipped for run-and-gun operations. (N6CL photo)

Photo 3. A typical stop-and-shoot operation. (Photo courtesy the author)

the board. Rob Hedges, KC8YNI, had developed a drive-on mast mount. He describes it in his blog, which can be found at: <http://hobbyasahobby.blogspot.com/2013/01/update-portable-ham-radio-setup.html>. Look for the You Tube link toward the bottom of his text. You can also make a mast system yourself with a 2×10 piece of lumber, a few pipe fittings, and some TV-style mast, all of which you can obtain from a do-it-yourself hardware store.

Luggage/Sports Rack Mounts: Use your existing luggage rack to mount antennas, or adapt one of the popular sports racks (Yakima, Thule, etc.). There are a variety of mounts available that use 3/8-24 thread that can be really useful with 3/8-24 rods. Some of the best mounts are available at truck stops, targeted at the CB market.

Magnetic Mounts: Lots of different mag mounts can be used, often with the 3/8 -24 thread.

Bumper Mounts: Whatever you can fabricate yourself for your vehicle will work.

Hitch Mounts: Many rovers have developed schemes for mounting masts on the standard 2-inch square Class III hitch receiver found on many vehicles. In his blog, Rob Hedges mentions etrailer.com, which has a huge variety of trailer accessories. Here is a link to its website: <https://www.etrailer.com/>.

Power

Many rovers use linear amplifiers to provide for a boost in transmit power. Often VHF and UHF amplifiers have low-noise preamps built-in, which help on receive. Increased output power means more attention must be paid to supplying DC power to the station, which means using large (8 gauge or larger) wire. A 150-watt, 2-meter amplifier will draw about 20 amps of 12-volt DC, which is a lot of current. Just one tenth of an ohm wire resistance will drop the supply voltage by 2 volts! A 300-watt amplifier draws about 48 amps, which requires, at a minimum, 6-gauge wire size to be safe.

For simple stations, you can just power the rig from your vehicle's 12-volt battery. However, you will need to run that large-gauge wire directly to the battery. Also, you will need to start the engine periodically so that you do not run down the engine's battery. Many rovers use a separate battery to power their stations so as to not run down the engine's battery.

Trust me, this is easy to forget about when 6 meters opens and you are the target of a large pileup. Also, while most of the road-assist membership programs will go a long way to help you with your dead battery, off the road somewhere is not likely to be one of those locations to which they will go to assist you.

Location(s)

Once you figure out what equipment you will use, you need to decide where you will go. The run-and-gun approach will result in choosing an operating route, while the stop-and-shoot approach focuses on a set of operating locations. Either way, thinking through the route you will take is very important, since it affects how much operating time you will ultimately have in each grid.

Choice of operating location depends on three main things: grid rarity, accessibility, and propagation to other stations. Grid rarity means that you want to operate from rare grids, ones that are not likely to be activated by other operators during the con-

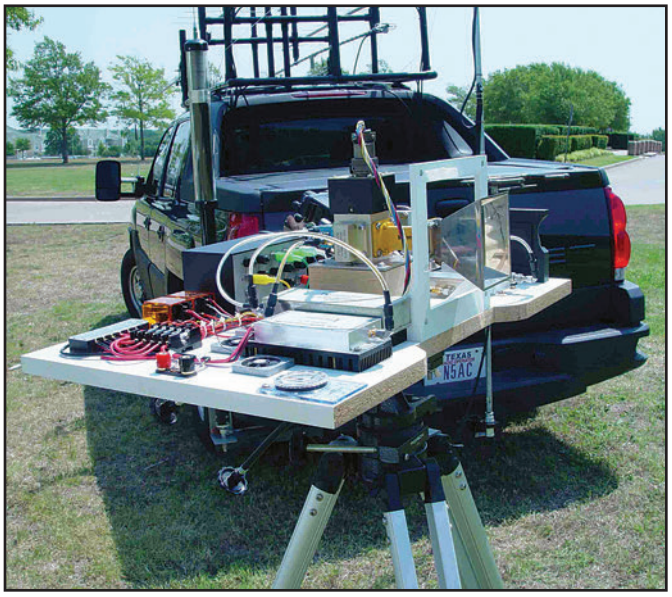

Photo 4. N5AC can also stop-and-shoot. (N6CL photo)

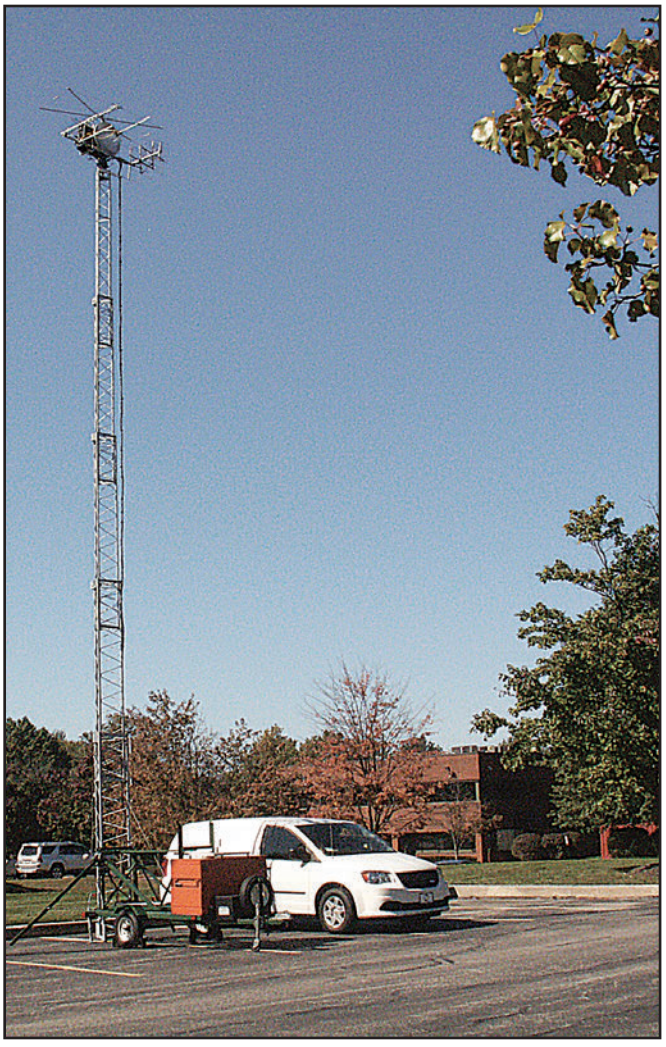

Photo 5. Wayne Overbeck, N6NB, is an example of a serious stop-and-shoot rover operator. (N6NB photo)

test. For example, DM78, DM79, and DN70 along the Front Range of Colorado have large populations of hams and will be activated during the contest. By being in a rare grid, such as DM94, in the panhandle of Texas, you offer a larger incentive for serious contesters to work a little harder to make contact with you. In addition, less serious ops who are working toward VUCC or FFMA will also make it a point to work you.

Accessibility means that you need to be able to get to the location quickly. This is a serious concern, since many locations in the mountains look attractive until you consider the time to get there. Snow can block backcountry roads, including during the June contest, since it is still early in the summer season.

Operating locations should have good propagation to other stations. Fundamentally, the point is to make contacts, so if you are on top of a mountain with awesome propagation paths to locations with no one to work, it does not contribute to your score.

For example, in Colorado you will want to consider your propagation path to the Front Range, where most of the stations are located. In Texas, you will want to be able to have a clear path to the Dallas-Ft. Worth metroplex. Good locations are higher than the surrounding terrain with an unobstructed view in all directions. A careful review of topographical maps will help you choose the best spots.

Maps, GPS, and Other Aids

In the Tulsa, Oklahoma area you have an excellent opportunity to operate from four grids in fairly short order. Grids EM15, EM16, EM25, and EM26 intersect at the cross point of U.S. Highway 75 and State Highway 117. *CQ VHF*'s Editor, Joe Lynch, N6CL, and Tommy Henderson, WD5AGO, both have used this grid intersection to give out points during VHF contests.

For the most part, however, you will need a reliable means of knowing in what grid you are located. This starts with a macro view of the state. Where are the grid lines at a regional level? I have a Colorado map with grid lines on it here.

It is also very useful to have a standard state road map (one with roads and some geographic info on it) with grid lines drawn on it. This will give you the big picture of where you want to operate as a rover. Even so, you generally will need something more precise to determine your exact location. The obvious choice here is a GPS receiver that can be set to display the "Maidenhead" grid directly. Another alternative is a good set of topo maps. However, with the reasonable price of GPS gear, it seems like the way to go.

A laptop computer is very handy for logging purposes. One popular logging program that can handle rover operation is "VHF-DX." While it is no longer supported, Ron Johnson, K7UV, has supplied information on its current usage at this website: <http://www.k7uv.com/software1.htm>.

Some rovers still use paper logs, but you'll need to have a scheme for keeping track of whom you have worked from each grid. Otherwise, after working three bands from three grids, you cannot remember if you need a QSO with a particular station or not. Some rovers just tape record their entire effort and sort it out later.

FM

I mentioned above that the vast majority of contest operation is on SSB. Some heartier rovers also use CW. It is important for you, the rover, to know that FM can be used in the contests. However, note that use of 146.52 is not allowed.

My rover vehicle already has a 2-meter/70-cm rig, so I usually monitor the standard FM simplex frequencies during a contest. Usually I make a number of contacts there and it is a chance to generate some interest in serious contesting with the folks who hang out on FM.

It is also common to run into operators who have 2-meter SSB but can only run FM on 70 cm. Not a problem, because we can QSY over to 446.00 MHz to make an additional contact. On the other hand, I have only FM gear on 222 MHz, so I ask SSB operators to go to an FM simplex frequency and work me via FM. I often bring along a horizontally-polarized Yagi (not common on FM) for making these contacts so that I don't suffer the signal loss associated with cross-polarization. For weak-signal work, FM is *far* inferior to SSB and CW, but it may be a way for you to add an additional band to your station.

Summary

Rover operation is *fun*! It starts out with the fun challenge of equipping your station and figuring out how to make it work. The actual event is fun because it gets you out of the shack, out of the house, and cruising down the highway. Instead of being just another station in Denver or Dallas or Des Moines, now you are a new grid. Once you give this a try, you will find all kinds of ideas on how to approach your next rover operation. So give rover operation a try and have some fun.

I think that it is only fair to warn you that roving can be addictive and your family and friends may try to obtain professional help for you. Concerning your new-found addiction, here are some additional web links where you can see pictures of rover vehicles and read about some of rover operations:

Jim Smith, WØEEA: <http://www.w0eea.com/rovradio.htm>

Roberth Aldrich, N9RLA: Resource Page <http://www.qsl.net/n9rla/>

Bdale Garbee, KBØG: <http://www.gag.com/code/rover/>

Thomas Mayo, N1MU: <http://www.2ub.org/n1mu/rover/index.html>

Rus Healy, K2UA: <http://www.kkn.net/~k5tr/k2ua.html>

Cedar Rapids Microwave Society (Rovers): <http://www.rf.org/crms/rovers.html>

SCERN: The South Counties Emergency Network – A Work in Progress

VHF FM communications has evolved significantly over the past 40 years. At times it has been a struggle for EmComm operations to stay current with the changes. Here WA3UVV describes how one regional network is doing so.

By Cory GB Sickles,* WA3UVV

In the 1970s, the explosive growth of 2 meter FM was everywhere. When I first upgraded from Novice to Technician, most of my QSOs were simplex. I could work two repeaters, both of which were a 30+ minute drive—in different directions. Within two years, I could talk to other hams in all directions on more than a dozen. A few of them were eventually linked together with other repeaters via limited UHF bridges.

In the 1980s, a "plug & play" approach to digital communications came into vogue—packet radio. Rapidly replacing and surpassing any RTTY repeater usage, packet protocols and the emerging network or bulletin boards and routers allowed inexpensive computers and portable transceivers to form intelligent wireless terminals that could (eventually) send messages all over the world.

In the 1990s, the "tipping point" of the internet and increasing speeds with ever faster and less expensive computers with sound cards sparked the idea of digitizing voice conversations and repeater linking.

Tim Cwik, N2LTQ, Cape May County RACES RO (standing), addresses questions at a SCERN meeting held in Atlantic County. Tim and Bill Cole, N2CSA, Cape May County AEC, drove the early D-STAR experimentation through JCDUG.

In the new century, ideas about being able to pack some digital magic inside transceivers, allowing voice and data to be passed via linked connections across computer networks, went from scratch pads and white boards to reality. Terms such as talkgroups, reflectors, vocoder, and more entered the vocabulary of some leading-edge experimenters.

With that history in mind, VHF and UHF amateur radio today is a mix of analog and digital voice, plus data and wide-area linking capabilities. Through various means, we are able to select a range of networked repeater options and even pass text messages through our radios. Whether it's a borrowed LMR technology such as P-25, NXDN and DMR (TDMA) or a ham-specific methodology like D-STAR, our abilities to extend the range of our hand-held portable rigs is greater than ever.

While it's fun to play with these technologies and use a small portable to talk with other hams throughout North America and the other continents, there's a serious side to implementing these networks—public service and emergency communications.

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Growing up in southwestern Pennsylvania, we had state (OK, commonwealth) history in 8th grade. While covering some summary information about our neighboring states, my teacher pointed to the state in which I now live and said, "This is New Jersey. Its primary purpose is to keep tidal waves from hitting Pennsylvania."

In two recent years, New Jersey experienced a strange year of natural disasters and events. We had a high-speed, straight-line "super derecho" wind pass through and create damage (more information at <http://www.accuweather. com/en/weather-news/deadly-super-derecho-strikes-m/67383>). Hurricane Irene made landfall and left many without electricity for weeks. Flooding, downed poles, trees, and other debris stopped traffic in many areas. Injuries and loss of life were further results. We even experienced an earthquake, centered near Washington, DC. Some gallows humor ensued, with many of us wondering what was next—locusts or frogs. What we eventually got was deadly serious—Superstorm Sandy.

New Jersey's EmComm community, both amateur and the folks who receive checks for their work, spend a good deal of

time concerned with natural disasters and man-made harm that might be visited upon us from time to time. With the idea of keeping ahead of such things and utilizing state-of-the-art means to do it, a small group of ARES/RACES-oriented hams in Cape May began looking into D-STAR for everyday and emergency communications, forming the Jersey Cape D-Star Users Group (JCDUG) in 2007.

Because of a well-earned relationship with contacts at state agencies, an "umbrella" mutual-aid group—South Counties Emergency Radio Network (SCERN)—formed in the lower part of the state eventually was able to take advantage of redirected grant funds and build a D-STAR network as an additional resource to implemented analog solutions. (See "SCERN: A Network Built on Relationships," by WA3UVV in the October 2013 issue of *CQ* magazine, page 18.)

While my article in *CQ* covers the importance of relationships and mutual respect that can result in such funds becoming available, here we're going to explore the equipment, installations, and topologies.

When the opportunity arose to build an EmComm network with new technologies, some thought was put to other digital methodologies, such as P-25 and DMR. P-25 quickly was determined to be too expensive for amateur budgets and limited. DMR allowed more flexibility and was more affordable, but still would mean re-tasking LMR equipment. One attractive advantage of DMR is that most DMR repeaters allow "mixed mode" operation, where you can use your new digital radios and existing analog rigs with the same repeater.

D-STAR doesn't allow you to transition gently into the "undiscovered country." You have to make the commitment to digital in one shot. New Jersey's 2-

The D-STAR repeater stack at Rowan University in Gloucester County represents a typical layout.

View of hardline cabling and monopole with candelabra.

meter band is considered "saturated" with repeaters in just about all areas. Therefore, the 440-MHz band was envisioned as the solution for digital voice, since there's room to expand. D-STAR transceivers also allow for low-speed data transfers, which is fine for text messages, short e-mails, and the like.

For high-speed data, the ICOM ID-1, which utilizes the 1.2-GHz band, seemed the right solution. This would mean that each repeater "stack" would be configured with voice (DV) on 440 MHz and high-speed data (DD) on 1.2 GHz. There was no need to support digital voice on 1.2 GHz, thus saving money in this area and allowing it to be used to fund other gear. As an aside, all D-STAR transceivers support analog, so the ID-1s can be used with conventional 1.2-GHz repeaters, like the one in Gloucester County.

D-STAR is also the only digital protocol to be based around how hams would use such resources, and ICOM offers a complete product line with proven performance and support. With several considerations in mind, plus what had already been learned by JCDUG, D-STAR seemed the logical way to go.

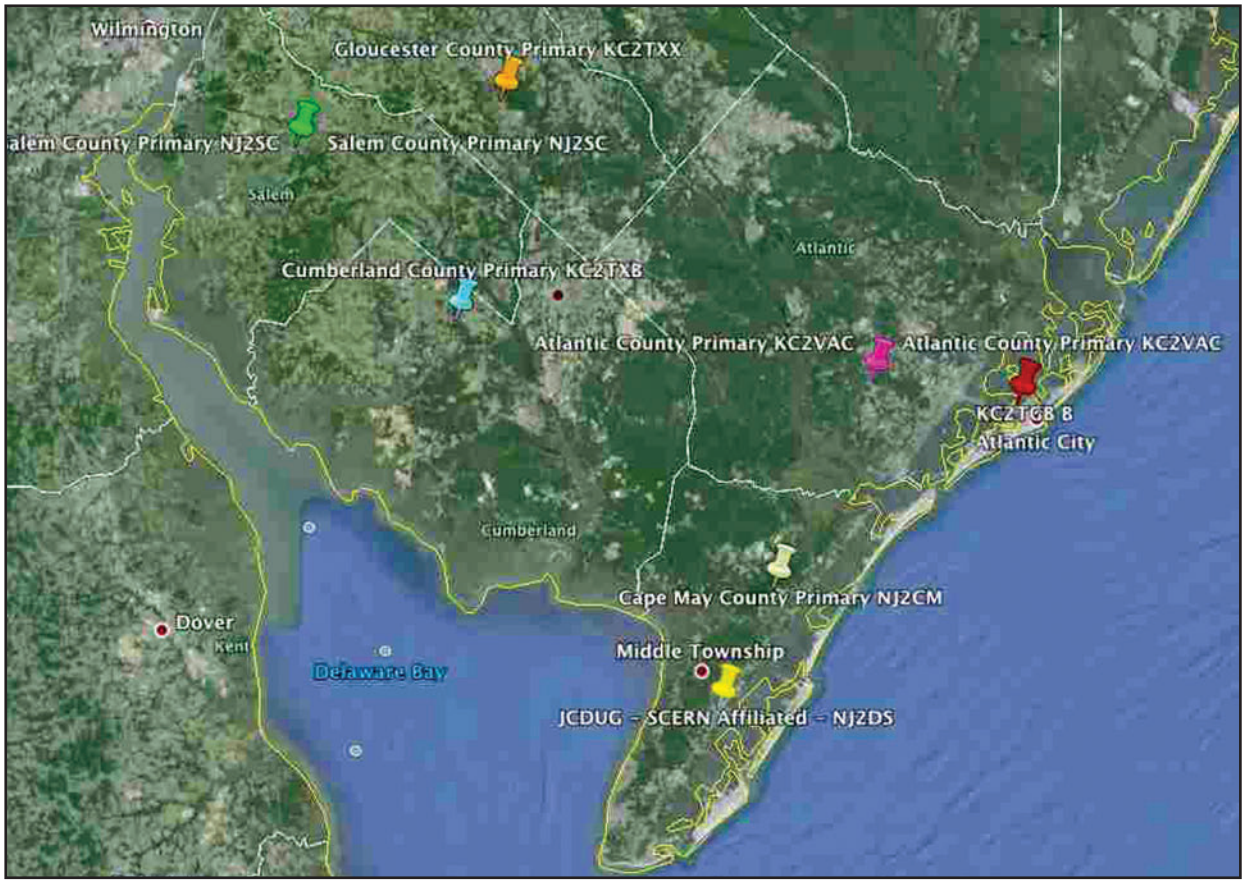
SCERN Repeater List

Frequency in MHz	Location	County	Callsign
440.09375+	Ocean View	Cape May	NJ2CM
440.10625+	Glassboro, Rowan University	Gloucester	KC2TXX
440.24375+	Lindenwold	Camden	K2EOC
444.65625+	Atlantic City	Atlantic	KC2TGB
445.03125–	Pilesgrove	Salem	NJ2SC
445.16875–	Egg Harbor Township	Atlantic	KC2VAC
445.31875–	Rosenhayn	Cumberland	KC2TXB
445.33125–	Mount Laurel, BCC	Burlington	KC2QVT

Please note: For details go to: <http://www.repeaterbook.com>

The ARRL SNJ section includes nine counties. SCERN's D-STAR network presently consists of eight repeaters, located in seven counties (more info at <http://www.scernet.org>). A look at the accompanying map will give you some idea of where they are located and the area SCERN needs to cover. Each repeater (typically located at that county's EOC) includes an ICOM RP-2C repeater controller, a Windows®-based PC for the controller, RPT-4000V 440-MHz repeater module, RPT-2D high-speed data module, power supply, UPS, 440-MHz duplexer, Diamond tri-band antenna, and all the cabling needed for installation. Because of the nature of the funding source, professional tower climbers had to be engaged. In truth, this sped up the implementation process and diminished safety concerns.

In addition to the SCERN repeaters, the original JCDUG (which is the only one in the area to support 2 meters) stack is also linked as part of SCERN via reflector 020B. Along with the fixed sites, an additional set of go-kits has also been assembled with ID-1 transceivers and support equipment to facilitate better coverage for data when needed. Plus,



The SCERN repeater map.

I Can Hear You Now

In most discussions of analog audio vs digital, one important factor is overlooked—clarity in high-level ambient noise situations. While digital voice won't win any technical awards for fidelity, it is precisely that narrowed frequency range that provides an advantage. During a response to an emergency, communicators may be in a fully staffed OEM bullpen, at a crowded temporary shelter, near crated animals, in high winds, or standing near ambulances, fire trucks, buses, locomotives, or even helicopters. In such situations, technologies such as DMR and D-STAR demonstrate a remarkable ability to maintain clarity and lessen the need for repeated transmissions. It takes some unaccustomed ears a little while to adapt to the sound of compressed, digital audio, but once you do, the benefits become clear.

Close up of HF, analog, and digital transceivers, with ruggedized cases.

ID-1 deployable go-kit includes everything needed in the case except for the 1.2-GHz antenna, which is carried separately.

there are other go-kits with ID-800H (predecessor to the ID-880H) and ID-1 for implementation in the field. These are housed in rugged Pelican cases.

Why so much emphasis on moving data? Well, consider the state of EmComm today and the mission of being able to support the Department of Health and Social Services (DHSS) as just one served agency. Incident Command System (ICS) forms are standardized ways to track patient movement, evacuations, on-site response, and virtually every situation or logistic need that may arise during an emergency. Plus, you may encounter a variety of spreadsheets, e-mails, NTS messages, word-processor documents, memos, and the occasional picture or diagram.

Passing information by voice is slow and error-prone and is not what the agencies we are serving are used to. By being able to send data (with an audit trail) in a format mimicking what they use everyday, traffic moves more efficiently with less errors and raises our "street cred." Do that and it's easier to gain their respect and funding support. In short, you aren't going to impress anyone by trying to move all that information with handwritten radiograms.

It Looks Great, but How Does It Work? SCERN in Sandy.

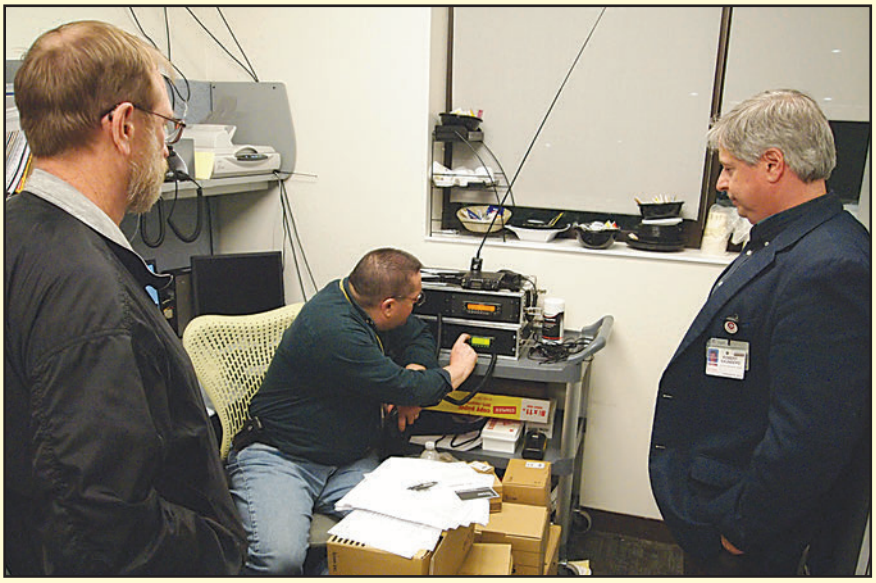
The severe weather and natural events I mention in this article demonstrate the strengths of our ARES/RACES resources in general and SCERN in particular. The damage and loss of life resulting from Hurricane Irene showed the system worked, but also provided an opportunity for improvement. This was true of the professional LMR and state strategic systems, as well. As an acknowledgement of how well amateur radio was doing, one official stated that he never wanted to go through another hurricane without hams.

One of the things we can be thankful for, in regards to hurricanes, is that they move slowly and afford us time to prepare. As the weather prediction "spaghetti models" converged, it became painfully obvious that this huge storm was going to combine with another system and produce a massive weather system—just before it made landfall—covering the Jersey Shore.

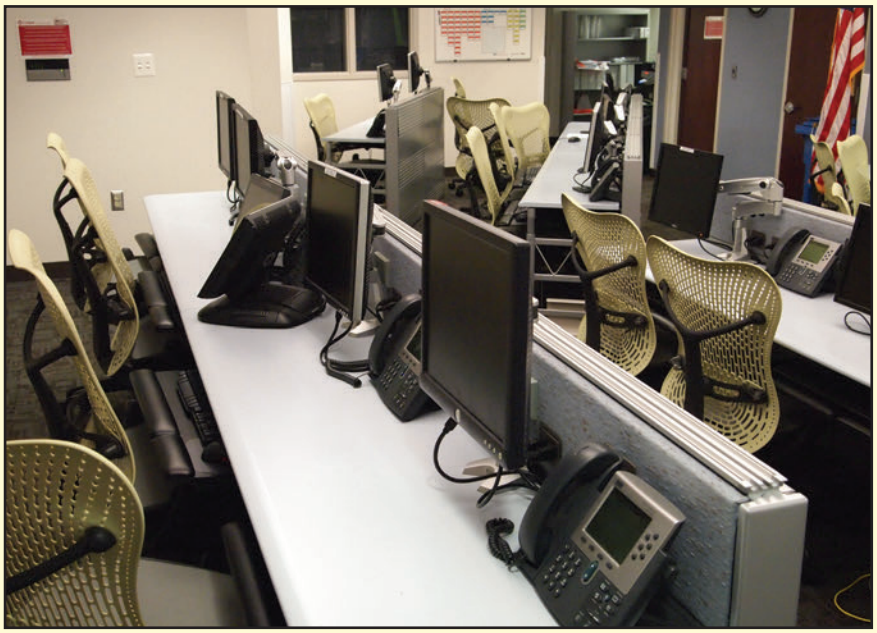
With lessons learned from Irene and previous exercises, our governor held a press conference and told everyone it was time to get off the beach. (Almost all complied, but there are always a few who elect to ride it out.) When reports of boardwalks breaking up, amusement rides twisting and disappearing, plus entire neighborhoods being washed away came into the Medical Coordination Center (MCC) at Cooper Hospital and area OEMs, many of them were first reported through the ARES/RACES volunteers of SCERN.

The key to effective and efficient disaster communications support lies in the preparation and flexibility of dedicated volunteers. As to the "nuts and bolts," both the D-STAR and analog elements of SCERN performed admirably. Hard work and the dedicated funding paid off again. Teams of amateur radio volunteers, professional communications personnel, and first responders worked together using the tools at hand to serve.

SNJ ARES/RACES and the SCERN group continue to expand and improve. There are still resource items and more volunteers needed to be a part of the ARES/RACES team.



Left to right: Ed Champion, N2RO, Gloucester County EC; John Zaruba, Jr., K2ZA, SNJ SEC; and Robert Saunders, KC2UYS, AEC and head of Cooper Hospital's MCC, discuss ideas at a SCERN meeting in Camden County.



Partial view of Cooper Hospital's MCC. During natural disasters, the room is staffed "wall to wall."

The other thing that high-speed data can allow is a limited number of Voice over Internet protocol (VoIP) telephone conversations and Wi-Fi connections via wireless routers. When cell systems and landlines are out and the Red Cross, other agencies, or hospitals need to stay in contact for mission-critical reasons, this provides an alternative.

There is a story told about one SCERN site set up during Hurricane Irene. Visiting personnel arrived and saw that they were able to communicate via smart phones. Not realizing they were using Wi-Fi, they stated that since the cellular network was back up, all the hams could shut down and secure. When the go-kits were powered off and the smart phones cut out again, they wondered what happened. It was a "teaching moment" that emphasized the value of amateur radio, ARES/RACES volunteers, and funding well spent!

As we don't have major disasters every day, the SCERN repeaters are operated as an open system and welcome any ham with D-STAR gear. Many times a given machine's reflector is switched to one that covers Europe, Asia, Africa, and other areas, extending the range of small radios and giving everyone another incentive to enter the digital world.

Prior to the D-STAR acquisition and implementation, analog FM rigs covering 144, 220, and 440 MHz were placed in area hospitals and care facilities. The stations are equipped for both voice and packet (Winlink) communications. These use either existing repeaters or simplex frequencies. They function with, not merely as a backup to, the primary D-STAR resources. Most of these stations also have HF transceivers, with NVIS antennas for intra-state and nearby communications. Redundancy is always a good idea, as sometimes plan A and plan B don't work as hoped.

The coverage could have been implanted with NBEMS, ALE, and a collection of different hardware and software. There's nothing really magical about one over the other, as long as you standardize on a set of tools and work to make the most use of them. For South Jersey, a mix of D-STAR and analog points of presence, along with certain software packages, made the most sense.

SCERN is in the process of expanding into two other counties—Mercer (home of Trenton, our state capital) and Ocean. There are also ongoing discussions about extending the network into NNJ section counties. This is being done through open invitations, not mandates. Leading members in our ARES/RACES and CERT organizations are less concerned with individual fiefdoms and more concerned about the "long view" mission—to serve the people in our communities and our state. It's this type of philosophy that makes a mutual-aid group such as SCERN possible and promotes amateur radio in a very positive way.

If you live in the area and would like to learn more about how you can be a valuable part of ARES/RACES, please contact the ARRL SNJ SEC, John Zaruba, Jr, K2ZA, at <k2za@arrl.net>.

About the Author

Cory Sickles is the ARRL SNJ Public Information Coordinator and writes monthly columns in CQ VHF's sister publications *WorldRadio Online* and *Popular Communications*. He is also a Volunteer Examiner and supports amateur radio in his area primarily by teaching license classes and looking for PR opportunities. Much as in his video production business, he states "I don't actually do any work. I just take pictures and tell stories about other people's work."

Hector Martinez, CO6CBF, shown here operating Field Day.

Being the QSL Manager for CO6CBF

WA5KBH's successful efforts as QSL Manager for CO6CBF and Hector's contacts via the amateur satellites

By George Carr,* WA5KBH

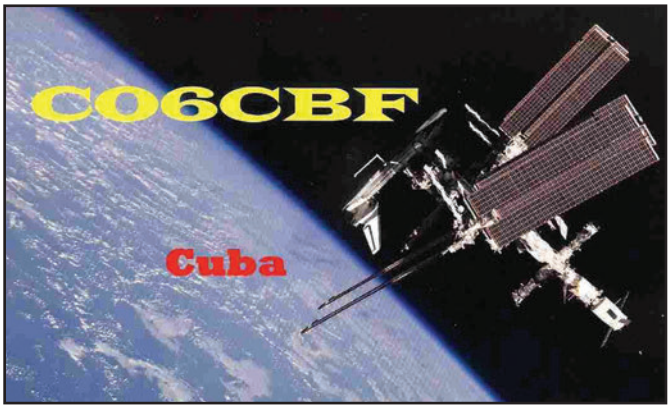
Regular readers of *CQ VHF* magazine were introduced to Hector Martinez, CO6CBF, in the Spring 2013 issue (see his article "Working Satellites with a Homebrew Setup Cuban Style" on page 18). Many of us who operate amateur satellites have worked station CO6CBF. Hector is a relatively new ham on the birds, although his history as an HF operator goes back to when he was an 11-year-old student. (He is now 24 years old.)

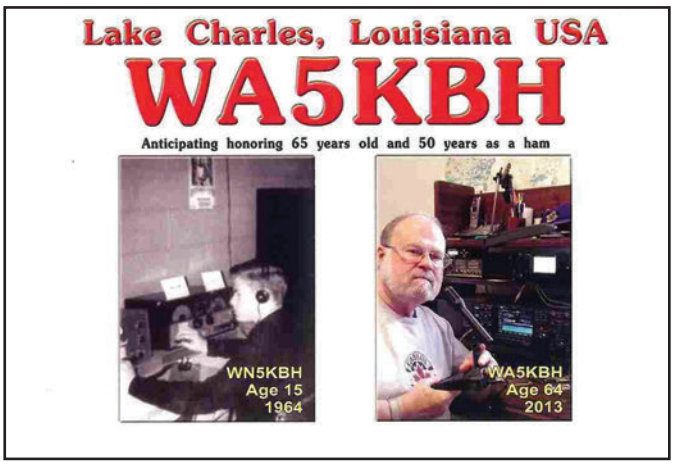
*e-mail: <wa5kbh@arrl.net>

And of course, when we work a new grid square or a new DXCC entity, we want to exchange QSL cards.

From prior experience in attempts at confirming HF contacts between Cuba and the United States (and I'm approaching 50 years as a licensed amateur operator), I knew it was common to get less-than-desirable results, becoming a source of frustration for both American operators and Cuban hams, lately including Hector.

Hector's first amateur satellite contact confirmation cards to arrive in the U.S. were carried by a person who visited Hector's





neighborhood. Hector asked for a bit of help from him, and he carried back the cards and forwarded them to John Papay, K8YSE, for distribution. John addressed the envelopes and sent each card to the proper station. He put 75 cards in the mail. Just two of them were in envelopes received by Hector in Cuba, and the others were unsolicited cards requesting a reply. However, prior to this effort, Hector received just 15 replies via the Cuban postal system.

Founded on a desire to assist Hector as well as the growing number of United States hams working him via the amateur satellites, I contacted Hector and volunteered to serve as his stateside QSL manager. This was in late 2010.

In 2011, Hector took me up on my offer and turned over the QSLing responsibilities to me. Hector has operated portable from his home grid EL92, as well as from EL71, EL72, EL82, EL83, EL91, EL92, EL93, FL01, and FL02. (This includes some single grid operations as well as grid lines.)

As of near the end of July 2013, I have been the manager for 6,362 contacts, involving writing 405 QSL cards and keeping track of 598 cards received from hams who graciously sent cards to me for Hector confirming portable grids that they worked, and cards for his VUCC as well as WAS awards. (The discrepancy between QSL cards received and sent is due to U.S. hams operating in portable grids and not requesting a return QSL card.)

Via e-mail, Hector sends me his electronic logbook kept on N3FJP's Amateur Contact Log 3.0 and I import it into a master Ham Radio Deluxe logbook. I have learned *the hard way* to keep a backup of his logbook on a thumb drive!

Hector was one of the first Cuban hams to use Logbook of The World. John, K8YSE, helped him accomplish all of the ARRL procedures to set up LoTW. Hector handles his own LoTW contacts and confirmations, although I am involved in the applications for endorsements. You might be interested in the fact that as of this writing in September, and not the date of his prior article in the spring issue, Hector had 215 grids confirmed via LoTW and 298 by paper QSLs. (And the number of hams using LoTW for QSO confirmations is growing daily. Maybe I'll lose my QSL Manager position soon? I highly doubt that! Hi!)

The majority of cards coming to Hector and requesting a card back include an SASE, although there are some with only an SAE or (infrequently) not even an SAE. On the other hand, a few hams even include a dollar or two or a few extra first-class stamps to assist me. I appreciate that form of courtesy and it has saved me a few green stamps on purchasing postage stamps and envelopes. John, K8YSE, has been kind enough to keep me supplied with Hector's QSL cards.

Unfortunately, I was unable to travel to Orlando for the recent AMSAT symposium to meet Hector in person. That would have been a real treat for me!

I wrote this article for a few reasons:

- There are other hams in various Maidenhead Grid Squares in Cuba who will likely—if they have not already—experience the same difficulties as Hector has in exchanging QSL cards.
- You may wish to consider offering to serve as a QSL Manager.
- You now have knowledge of what is involved in serving as a stateside QSL manager for a Cuban ham; and
- You might use this story as a springboard for your imagination to see how you might be an ambassador from the United States to hams in other countries.

DSP Circuits for Beacon Monitoring

This time WB6NOA tells how VHF/UHF weak-signal operators use the power of DSP to kill the noise.

By Gordon West,* WB6NOA

Propagation beacons are coordinated to the ARRL band plan to provide interference-free monitoring for a band opening. Tropospheric ducting on 2 meters, and shorter wavelengths, usually takes place in the summer months of July, August, and September.

Six-meter and 10-meter sporadic-*E* skywave openings are common summertime occurrences, independent of the sunspot cycle. Six-meter and 10-meter skywave contacts may surprise you with double-hop contacts in the winter, too!

CW beacons and MFSK beacons are found in Table 1.

For those of you on HF, 14.100 MHz is the spot to listen to the 18 beacons throughout the world, thanks to management by the Northern California DX Foundation, with additional HF beacons at 18.110 MHz, 21.150 MHz, 24.930 MHz, and 28.200 MHz, all part of the International Beacon Project: <http://www.ncdxf.org>.

Weak-signal operators will tell us that the best way to hear skywave or tropo beacons coming out of the noise is to listen with the squelch wide open. This may be a good approach for *some* operators, but listening for hours to background noise takes some real dedication!

Many weak-signal operators may agree that using the radio's squelch circuit is generally unacceptable to detect a tropo beacon band opening.

"Running squelch to detect 6-meter sporadic-*E* openings may work OK because signals coming out of the noise will sometimes peak as high as S-9," comments Ken Neubeck, WB2AMU, a master of the Magic Band,"but no squelch for tropo beacon monitoring!" Table 2 shows Ken's favorite 6-meter propagation websites.

Many ham radio manufacturers offer an HF radio that includes multimode transmit and receive capabilities on VHF and UHF frequencies, as well. Some examples are:

Elecraft with transverters
FlexRadio with transverters
ICOM IC-7100
ICOM IC-9100, including 1.2 GHz module
Kenwood TS-2000, including 1.2 GHz module
Ten-Tec with transverters
Yaesu FT-817
Yaesu FT-857
Yaesu FT-897

Thanks, HF manufacturers, for including VHF and UHF multimode operation!

**CQ VHF Features Editor*
2414 College Drive, Costa Mesa, CA 92626
e-mail: <wb6noa@cq-vhf.com>

The SGC DSP speaker is amplified, with two levels of DSP.

Band	Frequency
10 GHz	10.3683– 10.3684 GHz
5 GHz	5760. – 5760.4 MHz
3 GHz	3456.3– 3456.4 MHz
2.3 GHz	2304.3– 2304.32 MHz
1.2 GHz	1296.070– 1296.080 MHz
900 MHz	902.100 MHz
432 MHz	432.300– 432.400 MHz
222 MHz	222.050– 222.060 MHz
144 MHz	144.275– 144.300 MHz
50 MHz	50.060– 50.080 MHz
29 MHz	28.200– 28.300 MHz

(Courtesy ARRL band plan)

Table 1. Commonly accepted VHF/UHF propagation beacon frequency allocations.

William Hepburn's Worldwide Tropospheric Ducting Forecasts: http://www.dxinfocentre.com/tropo.html
DXMAPS 2.6: HF and V-U-SHF QSO database lookup: http://www.dxmaps.com/spots/
DXMAPS 2.6 - QSO/SWL real time maps: http://www.dxmaps.com/index.html
50 MHz Propagation Logger: http://www.dxworld.com/50prop.html
Spaceweather.com: http://www.spaceweather.com

Table 2. WB2AMU's favorite 6-meter propagation websites.

With most of these newer rigs, monitoring with squelch ON may require many microvolts of signal strength to gate the squelch circuit. These newer rigs may feature "hard squelch" that may gate a transistor on or off, depending on incoming signal strength. This is fine for strong 6-meter openings, but squelch ON could easily mask the very subtle slow building of signals appearing just out of the noise on 6 meters, 2 meters, and 432 MHz, via tropospheric ducting.

The transceiver with "hard squelch" may be identified by putting on your headphones, turning the volume all the way down, and then rotating the squelch circuit from hard left to hard right. Do you hear a faint "pop" as the squelch gates on to off? This is a characteristic of a "hard squelch" circuit that may cause you to miss incoming faint CW or MFSK signals.

Do you own an old Kenwood TR-751 or TR-851, or Yaesu 726, with a "soft squelch"? Same with the very old KLM "Multi-2000" SSB 2-meter transceiver. A "soft squelch" circuit allows you to advance the squelch to a threshold where *anything*, including noise pulses, will pass through the "soft squelch" circuit as audio. Adding *slow* AGC (Automatic Gain Control), the audio circuit remains open for about a second, and gradually goes into silence without a pop.

"Tropo signals don't pop out of the noise like sporadic-*E* on VHF," adds Neubeck, WB2AMU, co-author (with me) of the book *VHF Propagation, A Practical Guide for Radio Amateurs*, available from CQ Communications. You may also contact Ken at: <Kenneth.Neubeck@exelisinc.com>.

"Only a couple of older dedicated VH and UHF rigs offered a 'soft-squelch' circuit," comments Jim Ford, N6JF, a regular on the every-July California-Hawaii tropo circuit.

However, there is a better way to monitor for VHF/UHF band openings, and that is digital signal processing! The new rigs have exquisite DSP circuits built in, either in the IF or AF. For your older rigs *without* internal DSP, there are excellent add-on DSP amplified speaker systems, ideal for hushing the hiss.

Noise reduction in most digital signal processing circuits may first begin with sampling the incoming signal in the analog-to-digital converter. An adaptive speech filter is designed to extract meaningful signals out of the background hiss (noise). Unwanted background noise remains relatively stable as compared to the human voice or CW signals with ever-changing spectral variations.

It takes about two seconds for white noise to be stripped from meaningful signals, and it is the meaningful signal that is then transformed from digital back to analog and passed through to your headphones or speaker.

Typically, constant white noise may be reduced more than 10 dB, and a constant heterodyne uninterrupted tone up to 75

SGC and West Mountain Radio DSP add-on speaker systems.

West Mountain Radio original DSP speaker with multi-level knob .

New from West Mountain Radio, totally variable DSP levels !

dB—a great way to cancel out a birdie on your favorite beacon frequency.

Fourier Transforms are generally considered one of the most effective ways of separating signal from recurring background noise.

In the newer equipment, with built-in IF or AF DSP noise-reduction circuits, dial in your favorite beacon frequency, squelch OFF, and then go to the menu setting for reducing the constant background hash coming over your radio's audio stage. When monitoring for a band opening, either voice or a CW beacon, aggressively hush the hash until your radio is nearly silent. As soon as a signal pokes through, get into the menu, reduce your DSP setting, and stand by for some DX!

Some VHF/UHF weak-signal operators prefer the simplicity of add-on DSP speaker modules and systems:

bhi Ltd.'s 10-watt amplified DSP noise-eliminating speaker, sold by GAP Antenna Products (http://www.gapantenna.com/)
GAP's "Hear It" DSP amplified speakers
GAP's "Hear It" DSP in-line and PCB modules
W4RT's bhi Ltd. DSP noise-eliminating modules (http://www.w4rt.com/ BHI/DSP-ANES.htm)
West Mountain Radio's 3-watt amplified DSP noise-eliminating speakers (http://www.westmountainradio.com/)
MFJ's "Brick Wall" DSP filter boxes (http://www.mfjenterprises.com/)
SGC's DSP Speaker systems (http://www.sgcworld.com/)

Use the same procedure for setting these DSP speakers and filter assemblies in action: Tune to the frequency of the incoming expected beacon or calling DX frequency, advance the DSP filtering to the point where the background noise nearly disappears, up your volume, and stand by for even the faintest signal blasting through. No squelch!

The DSP circuits—external or built-in—may have added capabilities for the following:

Automatic Notch filters for birdies and heterodynes
Adaptive noise reduction, multiple levels
Pre-set filtering levels
Bandpass filtering
Level input indicator LED
Provision for external base-station "favorite" speaker
Built-in transmit filtering

The last item, transmit filtering, is an absolute necessity for any add-on DSP speaker. If your transmit RF gets into the amplified speaker's circuitry, it will drive you nuts. One advantage

The bhi DSP speaker (available from Gap) amplified, with push-button level settings .

of the built-in DSP rig's circuitry is its *immunity* to passing transmit signals back through the headphones or rig's speaker. But external speakers . . . that's a big problem that both West Mountain Radio and bhi have addressed well.

"Our bhi (GAP) 10-watt DSP speaker underwent exhaustive design and testing to keep transmit RF *out*!" comments Graham Somerville, M3ZGS, from the UK. He indicates the bhi/GAP "Hear It" DSP systems rarely pick up transmit RF, but it was a job to get transmit RF from getting into the plastic enclosures of his 2-watt and 10-watt mobile/base amplified speakers. His new desktop "Noise Away" base station speaker with 4-inch base driver and 1-inch tweeter unit, 2.5 watts output, also underwent aggressive design techniques to mitigate transmit noise coming over the speaker system.

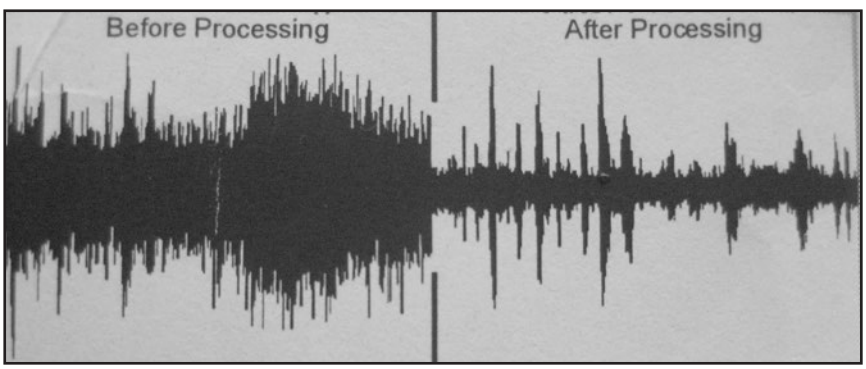
West Mountain Radio has a new re-designed amplified DSP speaker, and I've always enjoyed good success with its original DSP speaker with copious internal filtering.

I am a knob-twirler, so I enjoy the West Mountain Radio *knob* level adjustment control. bhi Ltd. offers up to eight selectable settings, accomplished by pushing a small button with additional possibilities to memorize favorite settings. This way, you don't need to cycle through all the settings to get to a couple of popular "full on" or "QSO" settings.

What happens when you use external DSP speakers with the rig's own built-in DSP function? No improvement that I have found over what a rig's DSP circuit can do, other than I like the ability of a simple knob or push button to pre-set DSP levels as opposed to going into the rig's DSP memory circuit. Adding DSP on top of the rig's DSP is not suggested.

Is the external DSP speaker system better than the internal IF or AF DSP circuits? I would consider IF rig DSP as the ultimate, with a close match between rig internal AF and external AF DSP, if the rig is like my old retired Kenwood 950, where its DSP internal circuit is not quite equal to my external DSP amplified speaker.

My Kenwood TS-950 now proudly resides at the Kenwood Atlanta, GA museum, and is still going strong. The new



Look what DSP noise elimination can do!

New Kenwood TS-990 with IF DSP circuits that really work well !

Kenwood TS-990 covers 6 meters built-in with a transverter jack to add transverter gear for any VHF, UHF, or microwave band of your choice. The IF and AF DSP circuits in the new TS-990 are extraordinary! Whether operating with transverters or monitoring for a band opening beacon coming through on 6 meters, the TS-990 has one of the most outstanding DSP circuits on the market. But keep in mind, this is a base-station *only* rig, 110 VAC operation.

The ICOM IC-9100, a 12-volt DC radio, with the optional 1.2-GHz band module that plugs and plays, is ideal for DSP beacon monitoring both in your shack as well as totally in the field. This is the rig we use exclusively in Quartzsite for the annual January Quartzfest™, W7Q, operation. You can dial in enough VHF or UHF digital DSP and sit on a specific distant tropo or skywave beacon frequency, and hear almost no audio coming out of the *un*-squelched receiver. As soon as a fraction of a microvolt of signal is detected, the beacon CW or MFSK signal will come out of the audio section loud and amazingly clear, just barely above the local noise floor. The ICOM IC-9100 is a fabulous weak-signal radio, in addition to its performance on high frequency.

For noisy environments in very noisy vehicles, the 10-watt amplified speaker from bhi Ltd. can really make a difference. Just set your radio audio output to about normal one-third volume and it will drive that 10-watt speaker plenty loud to be heard over any type of cab noise.

Here on the West Coast we monitor for the 2500-mile distant Hawaii beacon in the summer months. With squelch OFF, DSP ON, and the beams pointed toward Hawaii, I can hear the beacon through the normal 2-meter and 70-cm band noise many hours ahead of being able to make out the CW ID without DSP processing. So, cut the squelch, and add DSP noise canceling to increase the capability of hearing any weak signal coming in right at your noise floor. Your "better half" will sincerely appreciate your DSP monitoring over clicking squelch or incessant white noise hash.

If you operate HF mobile, or mountaintop on VHF and UHF with the engine running (or with a nearby generator), DSP can add to the noise-blanker and noise-limiting circuits to the gear you may already own. Simply plug in your 12-volt DSP active speaker, and find the right combination between your rig's own noise blanking and limiting circuits, with added AF (audio) DSP noise subtraction, to pull in much better reception from these stock or amplified DSP add-on speakers. Yes, you can plug in a set of headphones, too!

For those of us who still own single-band weak-signal radios with no built-in DSP, the add-on DSP speakers really make a difference!

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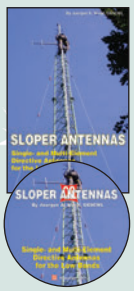

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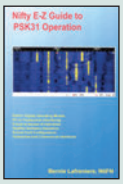

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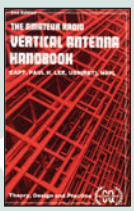

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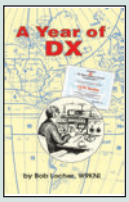

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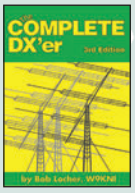

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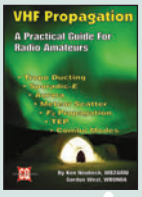

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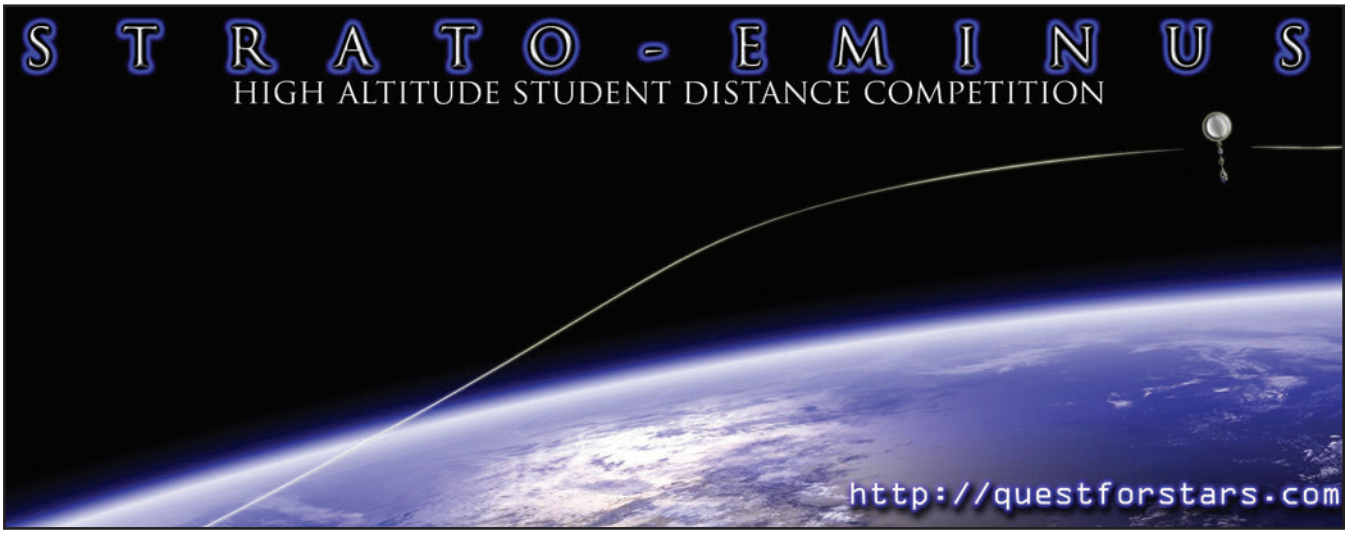


Photo 1. Logo of Strato-Eminus.

Strato-Eminus

A Student "Distance-Ballooning" Competition based on APRS

On the heels of the success of the Flying with Felix Baumgartner project, the Quest for Stars program develops a new project—besting the distance record set last year by Ron Meadows in the K6RPT-12 transatlantic balloon flight. Here KJ6NKA tells the story of how the project took off this past May.

By Bobby Russell,* KJ6NKA

After our success in capturing Felix Baumgartner jumping from the edge of space (see "A Student Front Row Seat to History: Flying with Felix Baumgartner," pages 8–16, Spring 2013 *CQ VHF* magazine), we were looking for a way to continue the Redbull® Stratos excitement for local students. To do so, Quest for Stars created the Strato-Eminus contest (see photo 1).

The contest objective was to have students build foam probes with modified APRS beacons inside, and fly them in an attempt to break the world distance record currently held by Ron Meadows, K6RPT (see "Transatlantic Balloon Flight 2012, CNSP-18 K6RPT-12," by Don Ferguson, AI6RE, pages 8–9; and "K6RPT – Recovery Report," by Patrick Marteau, CN2GW/F1GXW, pages 10–15, both in Winter 2013 *CQ VHF*).

Although we met with some challenges, we learned a lot and made some interesting advances in beacon configuration that has uses outside of the contest. The Strato-Eminus contest is now a yearly Quest for Stars program that will look to improve designs and flight duration. Data from the program will be shared and made available as open-source material.

**e-mail: <bobby.m.russell@gmail.com>*

Eminus

In Latin, eminus means distance. The current distance record for a latex weather balloon is just over 7800 miles. We set out to better that by designing systems that could support power and proper frequency switching requirements for an 8500+ mile journey. In perspective, that is almost double the operational range of an Intercontinental Ballistic Missile.

We knew this would be a difficult challenge for students given that Ron made many attempts before perfecting his design and setting the record (see photo 2). The first rule we put on students is they could not copy Ron's design and would need to design their birds from scratch. We also took on that challenge by creating a distance balloon fill table modeled after the National Weather Service's table fill mechanism. We had our

goals and now it was time to kick off the contest.

Probe Shape and Design

With a blank sheet of paper, we challenged students to tell us the best shape for such a probe. During our visit to High Tech High, one student came up with the idea to make the probe resemble the RedBull Stratos Capsule that Felix rode to his record-breaking Jump. That suggestion became the selected design for the contest.

It was off to Michaels craft store to purchase a large number of foam cones that the students could use to embed the Byonics MT-RTG beacon and the associated electronics. The only firm rule we put on the students during design is that it had to be the shape of a capsule and sturdy enough to take being whipped around for eight days of flight. This by itself was no small feat. The students did not disappoint and had slightly differing designs, each having merits (see photo 3).

Photo 2. Classroom discussion of the choice of the cone-shaped payload.

Frequency Switching

Next up was the challenge of frequency switching. Unlike Ron, we elected to skip the step of literally begging European ham stations to listen on North American frequencies if we made it that far. Two ideas were presented and considered. First was the idea of using a Arduino® NANO with GPS parsing and logging that would look at the GPS NMEA data and switch from North American frequencies to European frequencies when required. The second idea was the use of a standard flip-flop method of changing frequencies. The use of the Nano and GPS parsing was a great idea, but we found that the power budget was more than expected due to parsing and logging.

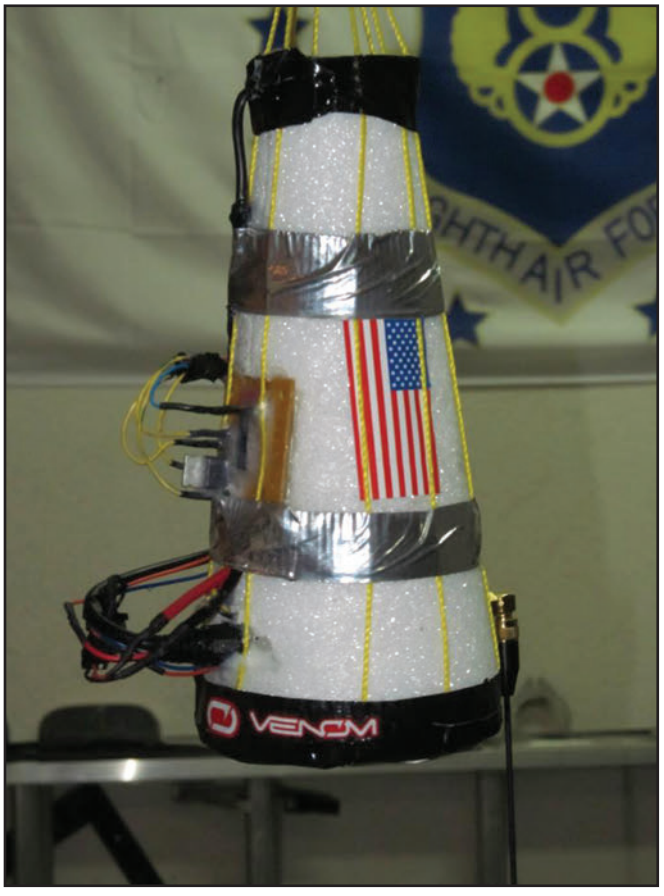


Photo 3. Close-up of the Eminus-2 payload.

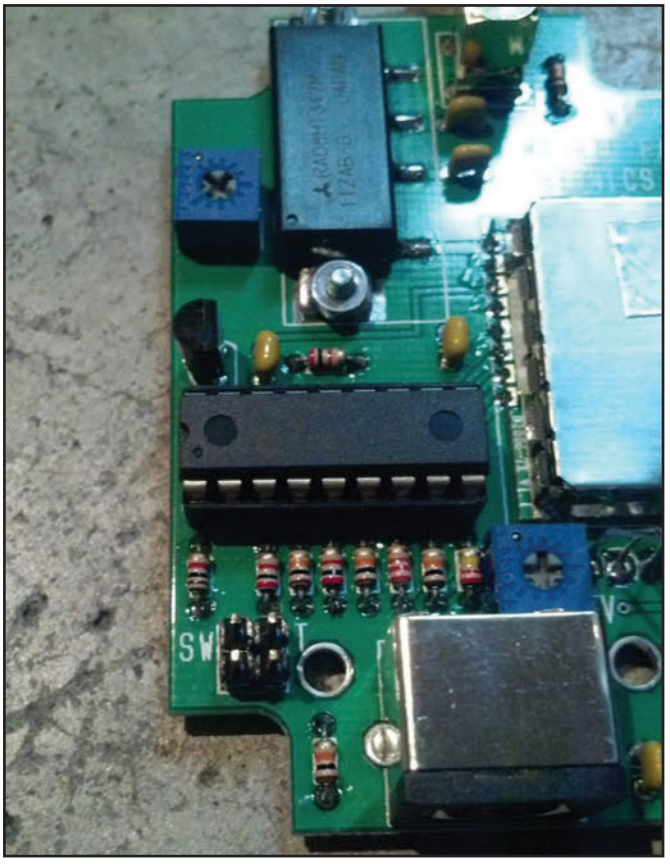


Photo 4. The MT-RTG beacon had standard jumper-pin pads that could be used to trigger the frequency switching.

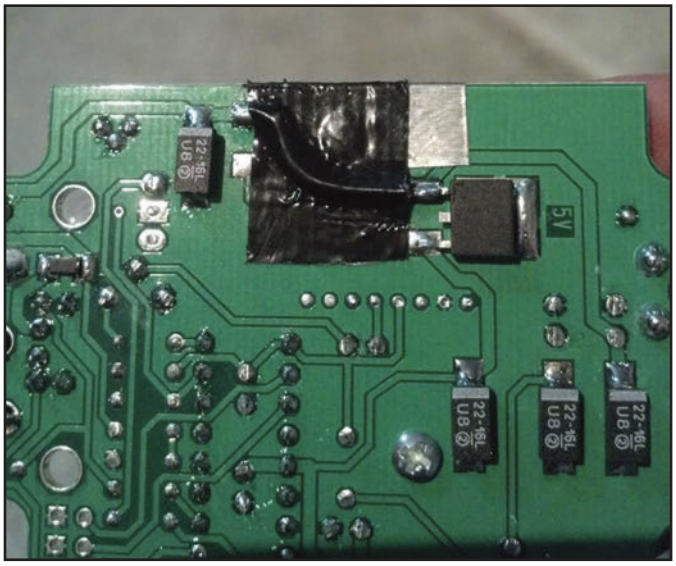


Photo 5. Underside of printed circuit board showing the MT-RTG 7812 removed and jumpered.

We found that the MT-RTG beacon (photo 4) when stripped down to the bare circuit board was an excellent form factor and it had standard jumper-pin pads that we could use to trigger the frequency switching (see photo 5). After a test run, we realized we could configure the beacon to do "back to back" packets every 15 minutes.

GPS Power Control

The biggest culprit of a long-distance Eminus probe is power drain from the GPS unit. So, working with students we came up with a design that allowed for the control of GPS power via a p-channel MOSFET. The remote power-on feature from pin 13 of the Byonics® MicroTrak PIC chip was tapped to provide a signal to not only toggle the 74HC109 J/K Flip Flop, but was also used to trigger the FQP27P06 P-Channel MOSFET. The design worked extremely well with on-ground testing and limited Cessna airborne tests. With power control we were able to get over eight days of battery power on a 2200 mAh Li-Po battery in tests.

Precision Balloon-Fill Mechanism

Staying true to our challenge to students, we set off to design a precision fill method that would not be a copy of Ron Meadows' fulcrum design. Although his design was elegant in nature, we were impressed by the exact and repeatable fill mechanism used at our local NWS sounding balloon station. It required a precision cutoff valve, and we considered utilizing an Arduino NANO to control the flow of hydrogen on our setup. In the end, we decided to make the table a "weighted horizontal offset scale" mechanism and manually controlled the fill of hydrogen with the luxury of a vent valve in case of overfill.

To give you an example of how difficult it was to get a precise fill, we are talking about the difference of 40–60 grams of free lift. This could not be accomplished outdoors so we used hangars that housed P-51 Mustang War Bird airplanes and high-performance motor gliders. After three test flights, we came to learn that we had to keep people away from the fill area and

Photo 6. Filling the balloon required working under the table.

located the bottle and the people doing the fill on the ground below the table. (See photos 6 and 7.)

Let's Fly!

Normally we launch one flight at a time, but given the invitation by Chuck Hall to use his P-51 nest at the Ramona Airport, we jumped at the opportunity to bring the first two student teams and local media to the location for launch of the contest. At this point over 200 hours of probe design, testing, fill-table dry runs, and troubleshooting had occurred. It was show time and the students were excited and nervous.

As the local media arrived we had already begun the fill on the second balloon. The media started interviewing the students and taking b-roll (supplemental) footage of the setup (photo 8). Once we had the balloons at flight pressure, the doors of the hangar were opened. To our surprise the balloons were so flaccid that they pancaked in the wind and we had to walk into a wind-shadowed area for lift off (photo 9). Once released, the balloons barely gained altitude and flew off into the distance (photo 11). The news coverage was awesome and the kids took pictures in front of the P-51 Mustang, "Six-Shooter" (photo 12).

Houston, We have a Problem

Once both flights were in the air we lost all radio contact. Since the probes had been designed slightly differently, what could be the issue? We went back to the lab and tested and retested everything. We were stumped until we spoke with Byonics. As it turned out, the students had turned the power potentiometers to the minimum position as part of their setup

Photo 7. Fill scale used for precise measurement of the weight of the helium used to fill the balloons.

Photo 8. Local TV station cameraman shooting b-roll (supplemental) footage the filling of the balloon.

Photo 9. The balloons were so flaccid that they pancaked in the wind.

of Eminus 1 and Eminus 2. We located the power problem and now realized why we lost contact with the birds.

It was a silly mistake and we didn't catch it. We told the students that we found the issue and took accountability for the mistake. When you are leading students, you must act like a leader when issues like this occur. They might have made the error, but our preflight checks should have caught it.

Eminus-3

With the power problem identified, we immediately set up a test flight dubbed Eminus-3. On this flight we decided to add some new trick solar panels, which we discovered as part of our Glider Project, that generated good power in a small and flexible form factor. These panels power a DC-to-DC Buck step-up transformer that trickle charges the 11.1 Li-Po battery while providing enough current to run the GPS during daylight hours. We added 30 more test hours in the sun to test the new changes and to ensure the beacon could hit the repeaters easily.

When Eminus-3 took flight we got a single packet from the beacon and never

heard from it again. We were once again disappointed, but learned something through follow-on testing: We could not shut off the GPS in flight and our added solar capability would offset 10 hours of the GPS running while it added a bit of power back to the battery. The second problem had been identified.

Going the Distance

Three days after the Eminus-3 flight, I was involved in a multi-rollover automobile accident that brought the 2013 contest to a literal screeching halt. Since then, I have recovered somewhat and have a few new helping hands to kick off the 2014 contest. It is our belief that Eminus flights are something any amateur radio operator could bring to a local school following the example set forth by Ron Meadows and Quest for Stars. In contrast to a standard balloon flight, the students will be able to watch the progress for days, versus hours for standard balloon flights.

Until next time: Happy landings and 73!

References

Web: http://www.questforstars.com
Facebook: http://fb.me/questforstars
Twitter: http://twitter.com/questforstars

Photo 10. Liftoff of the first of the two Eminus balloons.

Photo 11. Team High Tech members watch the ascent of the Eminus-1 balloon.

Photo 12. Two members of Team High Tech holding the payload after a test flight on the P-51 War Bird airplane.

Grounding and Bonding for Lightning Protection

Lightning is our nemesis. It can do strange and terrible things to our amateur radio stations. Combating lightning has its own issues. Here VO1KS tackles both.

By Warren Stone,* VO1KS

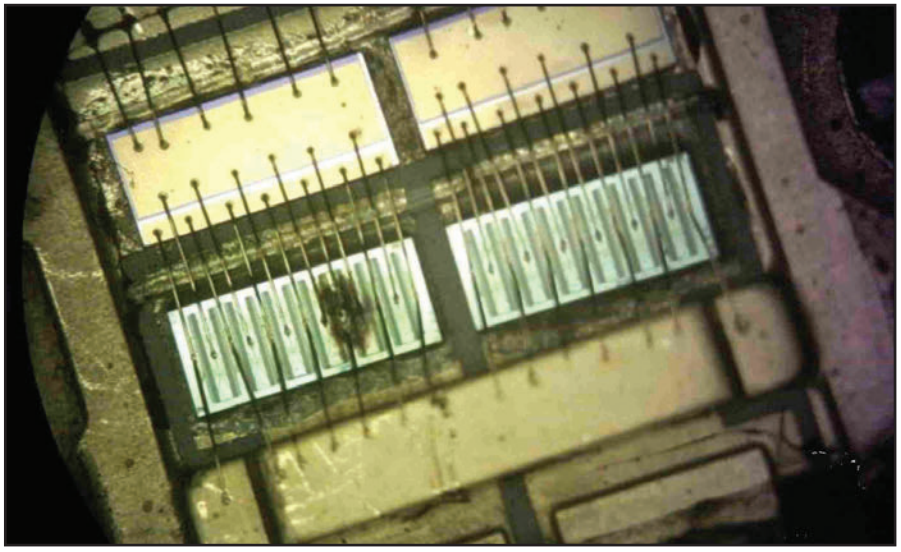
A typical broadcast site or ham radio station has two ground systems—tower and AC. Ground currents will flow between the two. The goal is to bond the two in such as way as to reduce or eliminate ground current flow through the equipment. Proper grounding techniques at the tower, anchor points, and AC entrance should be followed. Unfortunately, it seems the majority of times that bonding these points is neglected.

An average lightning strike will briefly produce roughly 30,000 amps of current. Let's assume the tower ground system has a total resistance of 1 ohm. This would be a very well-grounded site. Simple Ohm's Law will show the entire tower ground system will rise to 30 kV above true ground potential. This is perfectly fine and no damage will occur—provided that all equipment remains at the same potential.

The other ground system is provided by commercial AC power. The power grid will also provide a low resistance path to ground via the neutral conductor, the ground rods at the AC entrance panel, and ground rods at the transformers outside.

A direct lightning strike is not necessary to create a ground surge voltage. Nearby strikes can induce high currents and voltages into either system.

The solution to protecting the equipment is to have the tower and AC building entrances as close together as possible and well bonded to each other. Properly designed, current between the two ground systems should flow through the bonding connections—not the equipment. All equipment within the building will "float" at whatever ground potential there is between the two. People inside the building can go along for the ride.



A transistor damaged by a power surge. (Photo courtesy the author)

The easiest time to take care of grounding issues is when the site is being designed. Changes on paper are easy to make. While installing the site, a very low-impedance path between the tower and AC grounds must be supplied. Transmitter and equipment AC cables should have toroid chokes placed on them to increase their inductance. Similar chokes should be placed over the RF and control cables. High-inductance paths through the equipment vs. low-inductance paths between the two ground systems will provide maximum protection. The saying that lightning will take the path of least resistance is only partially true. Simple Ohm's Law and current-division rules come into play.

The transmitter cabinet and equipment racks should be isolated from the floor. The AC ground conductor should connect to the RF connector at the top of the transmitter, and this same point carried to the bottom of the rack via an insulated wire to the site ground strap. This will prevent the cabinet and electronics inside from being part of the ground current path. Nautel uses this technique extensively in its high-power transmitters.

In some sites there is a third ground system provided by the satellite receive dishes. I've seen major ongoing issues with LNB and receiver problems that cleared up immediately upon placing a heavy ground wire from the dish to the tower and building ground. It ensures the dish "floats" at the same potential as the rest of the site and prevents high ground currents from flowing through the electronics. Prior to the ground-wire installation it was difficult to keep the site on the air. Since ground-wire installation there have been no problems. Another site experienced intermittent breakup as unrelated equipment was switched on or off. There were similar poor installations in which TV transmitters were repeatedly losing power supplies. Studying the grounding configuration and determining how to rearrange wiring greatly reduced the failure rate. Toroids on the satellite coaxial cables and ground blocks at the entrance point provide added protection.

Damage to components may not be immediately evident. A typical high-

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This article originally appeared in the Proceedings of the 39th Annual Eastern VHF/UHF Conference. *It appears here courtesy of the author.*

power FET has a ceramic cover that protects hundreds of smaller FETs operating in parallel. A single surge could damage one or two of the smaller internal FETs. The transmitter AGC will compensate. Over time more and more FETs will fail and the AGC will become maxed out. The transmitter will no longer produce full power, yet no alarms will be displayed. The remaining FETs will be working harder and overall efficiency will be greatly reduced. Components weakened in this manner will eventually fail even if subsequent grounding or cooling improvements are made.

This transistor in photo 1 was still operational, could be biased, and was making power. A larger image is available here: <http://members.rennlist.org/warren/failedFET.jpg>. Look closely to see the power dividers/combiners to the individual FETs.

A microprocessor will pack many more transistors into the package than in a typical RF FET. It will not have multiple parallel transistors. Each junction will be much smaller and more delicate. A single transistor failure could render the microprocessor useless. New transmitters typically will be fully microprocessor controlled and have a considerable amount of digital processing. This makes proper grounding and control of ground-surge currents even more important.

Unless the two (or more) ground sources are properly bonded, the equipment between them can become the common jumper point. Very high ground currents may flow through the equipment possibly causing damage. The goal is to ensure that all ground systems "float" together and remain at the same potential. The absolute voltage during a ground surge doesn't matter provided they go there together. Having things bonded together properly ensures any current between ground sources and destination will not flow through equipment. With equipment chassis isolated from ground other than via the intended ground conductor, the current through the equipment is greatly reduced or eliminated.

It's not always easy to look at a site with copper ground straps running every which way and say it's done properly or to point at areas of weakness. Often ground systems are tied together in multiple places. With AC and RF entrances on opposite sides of a building it can be hard to understand how things work together.

The installation must be done properly at the very beginning. After a system has been placed on the air it is highly unlikely that you will be allowed to shut down to make improvements. Once equipment damage has occurred, grounding improvements may limit further damage, but cannot fix what has already happened. Compare to buying a new car and neglecting oil changes for the first several years. After suffering engine damage no amount of preventive maintenance will make things better. Once the damage is done it's too late.

Continuously monitoring ground resistance is impractical and likely of little benefit. Once installed nothing should change other than thieves or vandals stealing tower ground wires. It must be replaced ASAP once noticed, but even then as long as the main system bonds are in place both ground systems will remain at the same potential. In many places I've noticed copper ground wires on tower guy anchors being replaced with galvanized steel wire. While the resistance is considerably higher than solid copper, it is infinitely better than having no wire at all. The steel ground wire very seldom gets stolen. Another problem with missing grounding wires at anchor points has to do with shunting ground currents away

from the concrete anchor systems. There is a possibility for a direct strike to flow through the anchor and cause cracks in the concrete. Again, having higher resistance steel is much better than having an open system after thieves steal the copper.

When installing copper wire underground, the soil type could have an effect on the wire. Acidic soil will cause bare copper to deteriorate but will have little effect on tinned wire. Basic soil will have little effect on bare copper, but will remove the tin coating from the wire. The question becomes whether to use bare or tinned copper wire for underground installations. Consider using tinned wire anywhere underground. If the soil is acidic the tin coating will provide protection. If the soil is basic the tin coating will be removed but the copper underneath will not be affected. In either case tinned wire will provide the protection required.

The following information by Steve Parrott (http://www.cast-lighting.com/search/1/display-document/44), which applies to landscape lighting, has ground system application for us amateur radio operators:

Oxidative corrosion of copper will affect its conductivity. Electrical conductivity is a measure of a material's ability to carry an electrical current. Copper is an excellent conductor, making it ideal in all electrical applications. However, in the presence of air and moisture its surface oxidizes forming a layer of copper oxides that conduct electricity very poorly. This layer is not initially a problem since the layer is very thin and actually serves to protect the underlying copper.

In an outdoor corrosive environment, however, the oxide layer progressively extends deeper into the copper strand and eventually oxidizes the entire thickness. The resultant decrease in conductivity severely compromises the lighting system. Landscape lighting wire is especially prone to this severe corrosion because it is a stranded wire with very thin strands. Lighting installers often see the devastation of this effect when they pull old wire from the ground and see the strands completely blackened and brittle.

Tin-coating the wire protects from this type of progressive corrosion and loss of conductivity in two ways:

1. Sacrificial: The tin coating differs in electrical potential from copper in a way that causes the tin to be oxidized in preference to the copper. In other words, instead of a progressive deepening of the corrosion into the strand, the tin must completely oxidize before the copper interior is subject to corrosion.

2. Greater Conductivity of Tin Oxides: While copper oxides are very poor electrical conductors, tin oxides maintain good conductivity. This benefits the long-term conductivity of the entire wire bundle. Note: The initial conductivity of the tin coating is lower than copper, leading to a slightly higher voltage loss at time of installation. This difference is offset over time since the tin coating largely maintains its conductivity while the oxidized copper conductivity significantly decreases over time.

These documents regarding grounding and site preparation should be studied. By getting into the mindset of what is being said and understanding the concept rather than just reading and looking at pictures you can get an idea of what is the overall goal.

Polyphaser: Lightning Protection & Grounding Solutions for Communications Sites (4467kB): <http://members.rennlist.org/warren/LightningProtectionAndGrounding.pdf>

Broadcast Electronics: Installation Methods for Protecting Solid State Broadcast Transmitters Against Damage from Lightning and AC Power Surges (204kB): <http://members.rennlist.org/warren/ground.pdf>

Please email me with any suggestions or comments: <VO1KS@eastlink.ca>.

KH6HME Beacons Freshened Up!

For some time after Paul Lieb, KH6HME, became a Silent Key, the Hawaiian beacons limped along. Now, the stations are under new, organizational ownership. Also, an antenna pointing west has been added to explore propagation paths to Asia. Here K6MIO/KH6 and KH7Y write about some of the recent changes.

By Jim Kennedy, K6MIO/KH6* and Fred Honnold, KH7Y†

"A beam looking west? Yes, Paul Lieb, KH6HME (SK), indicated he would occasionally receive QSL card reception reports of the beacon being heard in Northern Russia (!), Japan, and Australia. Now with an antenna looking west, who knows what reception reports may come in from stations in the opposite direction!" comments Gordon West, WB6NOA .

"This past summer, all three beacons—2m, 432 MHz, and 1296 MHz—were heard along the California coast, and several of us worked the KH6HME team during last July's high-pressure duct, with signals as strong as S-9 on 2 meters!" adds West .

As the summer trans-Pacific tropo season wound down, on September 15th a group of Hawaii Island amateurs headed by Fred Honnold, KH7Y, did a major "fall cleaning" at the 8,200 ft. KH6HME beacon site on the east side of Mauna Loa on the Big Island. Perched at this elevation, even in Hawaii the facility is subjected to high winds, rain, and even sometimes ice and snow.

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†e-mail: <KH7Y@alohabroadband.net>

However, they were blessed with a calm and relatively warm day, and the crew spent more than seven hours replacing bent masts, servicing antennas, rerouting feed lines, and doing many other clean-up/fix-up tasks. Also, in the process one propagation experiment was ended and another new one begun.

Historically, there has been speculation and debate as to whether or not the 6-meter signals could be propagated by the tropospheric duct to North America's west coastal region. The anecdotal answer was that while 144 MHz and higher clearly do propagate, 50 MHz would not. However, it really wasn't tested in a *systematic* way.

To take a closer look, before the summer tropo season began Fred, KH7Y, moved the KH6HME 6-meter beacon system from its usual location about 200 ft. above sea level to the Mauna Loa site (temporarily) to see what would happen during the summer season. The results seem to confirm the earlier wisdom. There did not appear to be any 6-meter propagation that could be associated with tropo that is seen on the higher bands, or with known meteorological conditions that are normally associated with tropo.

On the other hand, a completely new experiment has been on the list for some time to explore whether the 144 MHz and higher tropo propagation that *is* observed from Hawaii eastward toward North America might also be seen from Hawaii looking farther *westward* into the Pacific. Therefore, the team has now pointed a second 2-meter beacon antenna at 277 degrees, which should illuminate a block of Pacific Ocean from KH2/KH9 to JA. It will be interesting to see how this works out over the next few seasons!

Another upgrade currently under serious study is establishing a small number of sea-level remote-control points. When tropo is reported, this will allow designated local operators to switch off the beacons and run two-way operations from the Mauna Loa site remotely from home on short notice. This would greatly increase the turn-around time and flexibility during openings.

As always, the team monitors and appreciates KH6HME tropo reception reports posted on: <http://dx.qsl.net/propagation/tropo.php>.

The beacon frequencies are 50.061, 144.277, 432.310, and 1296.250. Calling frequencies can be found on the website.

Two-meter antennas facing east and west. (Photo courtesy K6MIO/KH6)

KH6HME beacon shack facing west. Shown from left to right: Lloyd, KH6LC, Paul, WH6FM, and Mark (Paul Lieb's family), Fred, KH7Y, and one of Mark's employees from the water company that KH6HME owned. (Photo courtesy K6MIO/KH6)

By Bill Brown,* WB8ELK

UP IN THE AIR

New Heights for Amateur Radio

Tiny Payloads

Now that helium-tank prices are sky-high, wouldn't it be great to find a way to fly an amateur radio experiment that takes only a tiny bit of helium? Leo Bodnar (http://www.leobodnar.com/balloons) in the UK and Thomas Krahn, KT5TK, in Texas (http://kt5tk.wordpress.com) recently have designed some very tiny GPS-enabled payloads that weigh under an ounce. With payloads that tiny, you can actually fly a long-duration mission using mylar foil party balloons that will float above 20,000 feet for hours and sometimes days.

Thomas Krahn, KT5TK, has designed a board that he calls the Pecan Pico; it is loaded with features and transmits on the 144.39 MHz APRS frequency. His payload weight including a single AA lithium battery is around 28 grams (just under an ounce). He typically flies it using two or three large mylar foil party balloons and has had flights that lasted nearly 24 hours.

Leo Bodnar has designed an incredibly lightweight payload. It features a built-in GPS, a 70-cm transmitter, and transmits position data via DominoEX16. It has a rechargeable LiPo battery and tiny solar panels. Leo's tiny satellite weighs just 8 to 10 grams (less than half an ounce) and can operate day and night. With that tiny a payload, he can fly a mission using just one 36-inch diameter foil party balloon. Some of his recent flights have stayed up over a week and have circled all around Europe. This kind of capability can allow a trans-Atlantic flight and possibly even an around-the-world mission. You can track his continuing series of B-series flights (the most recent is called B-15) via <http://spacenear.us/tracker>.

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Off the Shelf

Inspired by these amazing feats of miniaturization, I decided to try some flights using off-the-shelf modules that anyone can buy and assemble together for a mission like this. I was also inspired by the thought of using a small $22 party balloon helium tank that you can lift in one hand versus a large helium cylinder that takes two people to lift and can cost hundreds of dollars. The trickiest part is to keep the weight under a half ounce (14 grams or less). It turns out that this is incredibly hard to do. I had to rethink my construction techniques and did away with mounting components on heavy proto boards. I had to solder together the three tiny boards with resistor lead wires and used the power supply wires to the solar panel as the support frame.

I opted for a totally solar-powered payload to eliminate the weight of batteries and charging circuitry. It turns out that a company called Power Film Solar (http://powerfilmsolar.com/products/oem) has just what I needed. I bought some of its OEM cells at the Dayton Hamvention®, and the one I used weighs just under 5 grams and powers everything nicely in full sunlight.

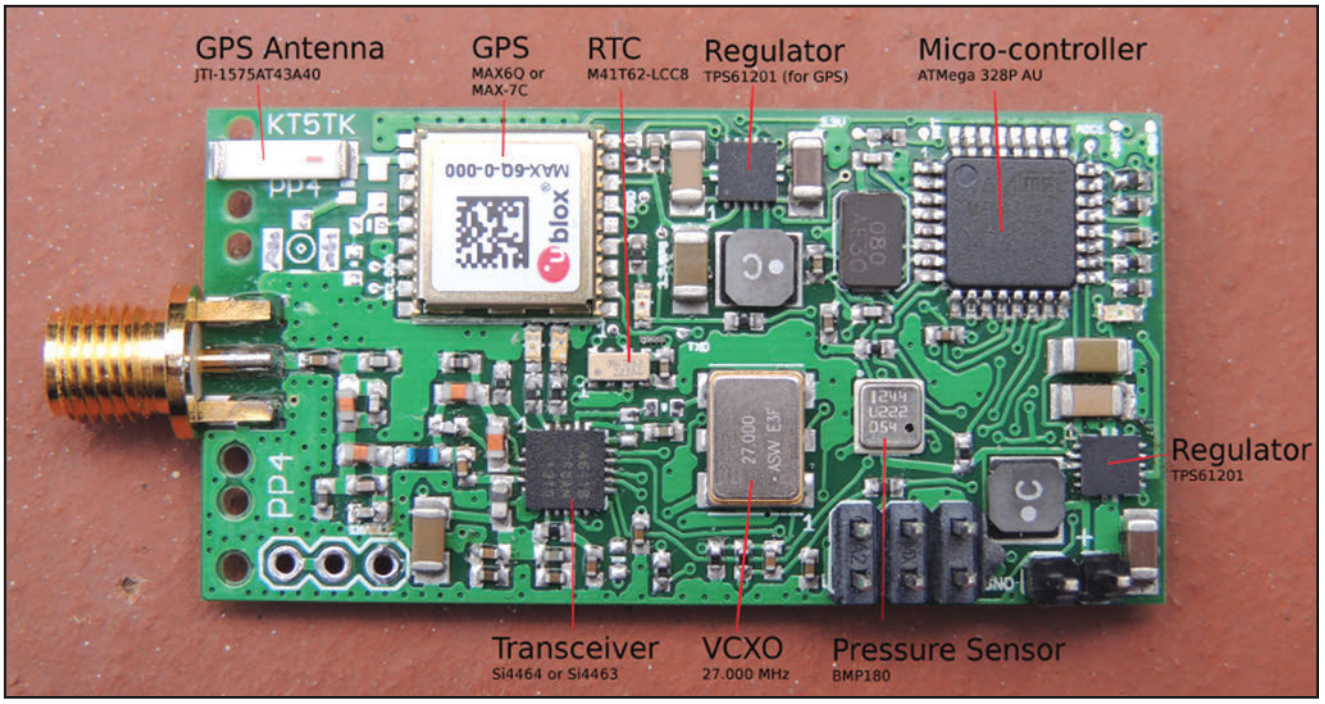

Photo 1. Pecan Pico miniature APRS transmitter by Thomas Krahn KT5TK.

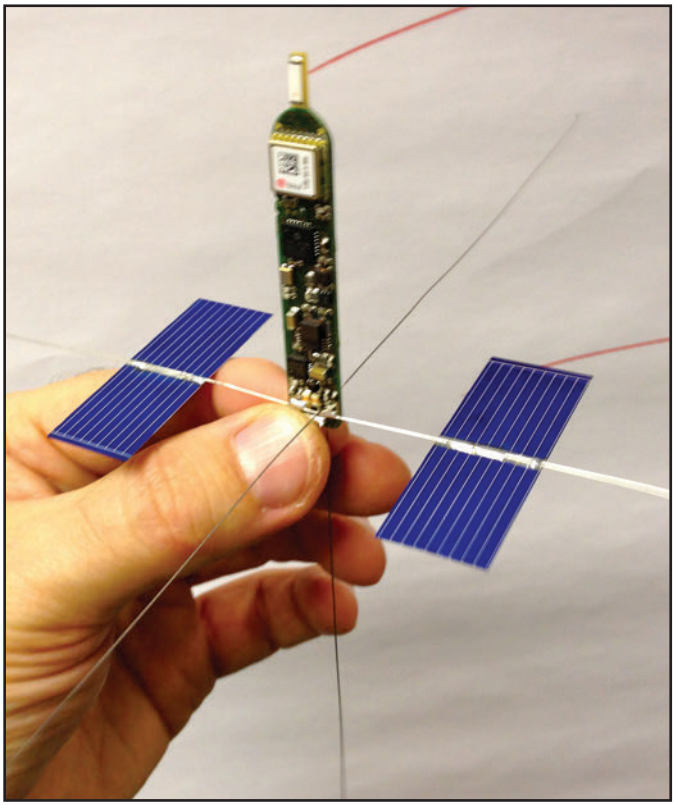

Photo 2. Micro-miniature B-11 transmitter by Leo Bodnar.

My payload consisted of a SparkFun (http://www.sparkfun.com) Arduino Pro Mini 3.3V microcontroller (#DEV-11114), a SparkFun 434-MHz wireless transmitter module (WRL-10534), a HAB Supplies (http://ava.upuaut.net/ store) u-Blox MAX-7C GPS module (#HAB-BO-M7PICOA– be sure to order the MAX-7C version), and a Power Film Solar OEM# MPT6-150 solar panel. I left everything exposed with no Styrofoam covering to save weight. The antenna wire solders directly to the ANT pin of the 434 MHz transmit module and I used stiff solid-conductor hookup wire to the solar panel suspended below the transmitter. My total weight came in right at my goal, just under a half-ounce (13 grams) with a current drain of about 35 mA and everything can operate down to 3.3 volts. The output power from the transmitter is only 10 milliwatts, but with a good gain antenna on the ground it can be received from quite a distance. During a recent flight from the Vette City Hamfest in Bowling Green, Kentucky we could still copy the telemetry from 100 miles away using a 5-element Arrow antenna and a Kenwood TH-F6A handheld radio.

The 434-MHz transmitter module uses a SAW oscillator which drifts around in frequency depending on voltage and temperature. To solve that problem, I AM-modulated the module simply by rapidly turning it on and off via its data pin. That way I never had to retune the audio frequency in the waterfall display of my decoding program and AM mode is fairly forgiving of frequency drift.

I used the DominoEX16 digital mode, which gives you excellent weak-signal decoding with few errors. I also encoded CW and Hellscreiber as well. I could barely hear the signal as it was

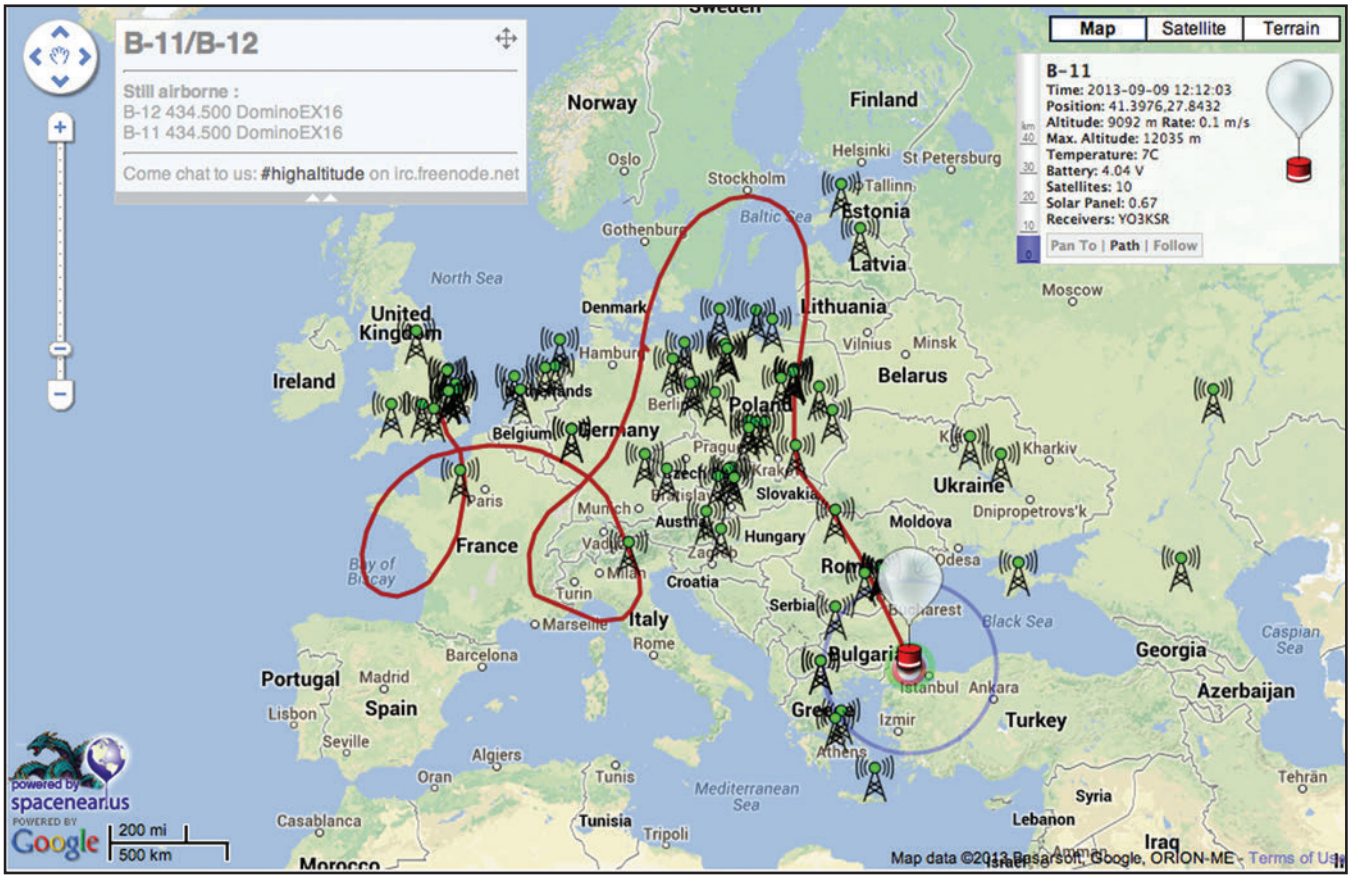

Photo 3. The B-11 payload tours Europe on its 9-day voyage.

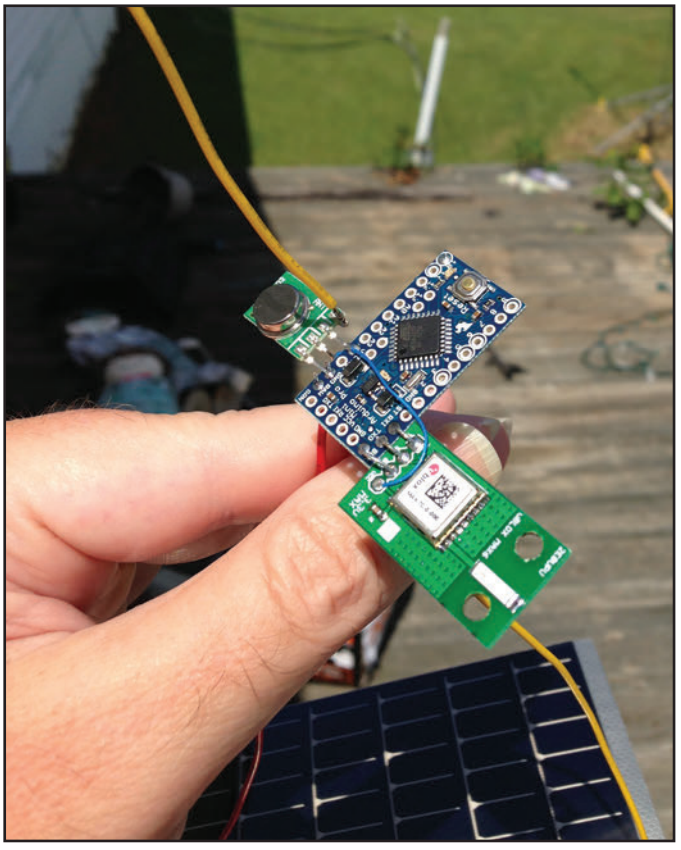

Photo 4. Close-up view of the WB8ELK micro payload.

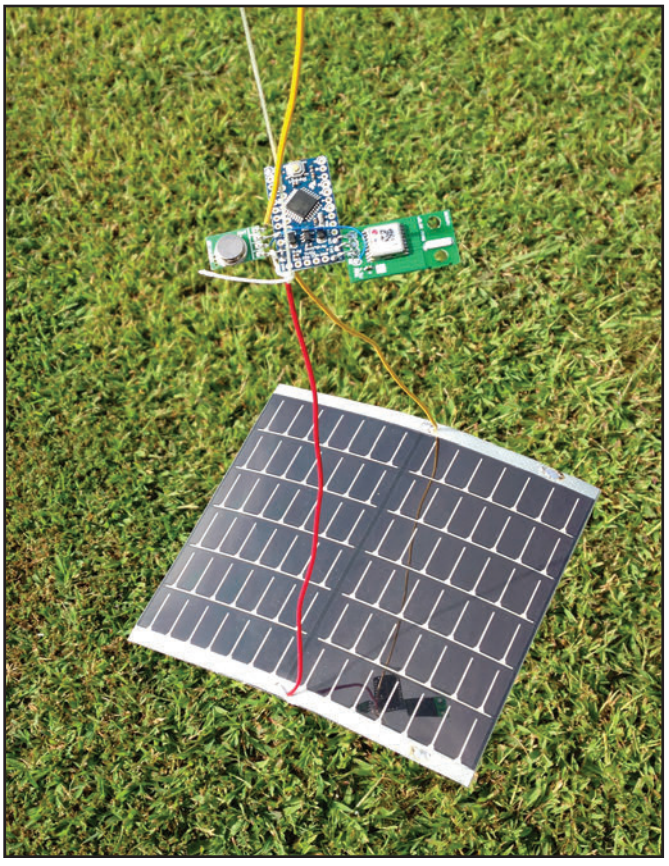

Photo 5. The WB8ELK solar-powered payload ready to fly.

flying out of my RF-range and I could still decode the signal perfectly. To decode the signals I used a specially modified version of FLdigi designed for high-altitude balloons. It's called dl-Fldigi and can be downloaded free (http://ukhas.org.uk/projects:dl-fldigi). Once a valid telemetry frame is decoded by dl-Fldigi, it uploads the position report to a website that displays your position (http://spacenear.us/tracker).

Flight Test

I ordered some 36-inch silver-colored foil balloons from a place called Balloons Direct (http://balloonsdirect.com). Using one of those small helium tanks that are used for inflating small party balloons, I made a small hose that attached to the tank and slipped the hose inside the filling port of the foil balloon (a drinking straw will work as well). The trick is to inflate the balloon to about 3 grams of positive lift beyond the weight of your payload. The balloon will be less than half-filled at this point. Much more than that and the balloon will likely burst at peak altitude during peak solar heating. Less than that and it has a good possibility of floating at peak altitude for hours and even days.

I inflated the balloon to lift the payload plus the weight of one penny. It turns out that a penny weighs exactly 2.5 grams and a nickel weighs 5.0 grams. By the way, if you inflate your balloon too much, you have to push the filling hose way inside the balloon to allow you to push some helium out of it. There is a special one-way valve inside unless you push the hose beyond it.

Bev Teter, KK4RPQ; Thad Drinkard, WB4VHF; and I launched the first flight from the front yard of my house south of Huntsville, Alabama. It headed up at about 1 meter/second (197 feet/minute). I had perfect copy on the payload until the sun went down. We estimate that it leveled out at about 25,000 feet and it flew all night. In the morning it was heard by Norm, WA4ZXV, in Waycross, Georgia and faded out as it traveled to the east. It appears to have burst just after noon during peak solar-heating after flying for 20 hours.

I figured that a payload that tiny would never be found, so I started to build the second one. The next morning I was surprised to get a phone call. Gregory Johnson in Waxhaw, North Carolina told me he found a solar cell sitting in his backyard and saw my phone number on it. How's that for balloon-mail? It flew over 400 miles and got there faster than it took to mail it back to me via US snail-mail.

Recently we flew another one from the Vette City Hamfest in Bowling Green, Kentucky. Hank Cantrell, W4HTB, of Bowling Green, KY could copy the signal out to 100 miles as it headed off to the East Coast. We estimate that it flew out over the Atlantic near Delaware by the next morning. Perhaps it might eventually be found in Europe.

These tiny payloads are a great way to fly a ham radio balloon experiment quite inexpensively and are a lot of fun to fly and track. It will be interesting to see just how far we can get one of these to fly, perhaps across the Atlantic or even around the world.

73, Bill, WB8ELK

Note

Arduino code examples can be found at <www.wb8elk.com>

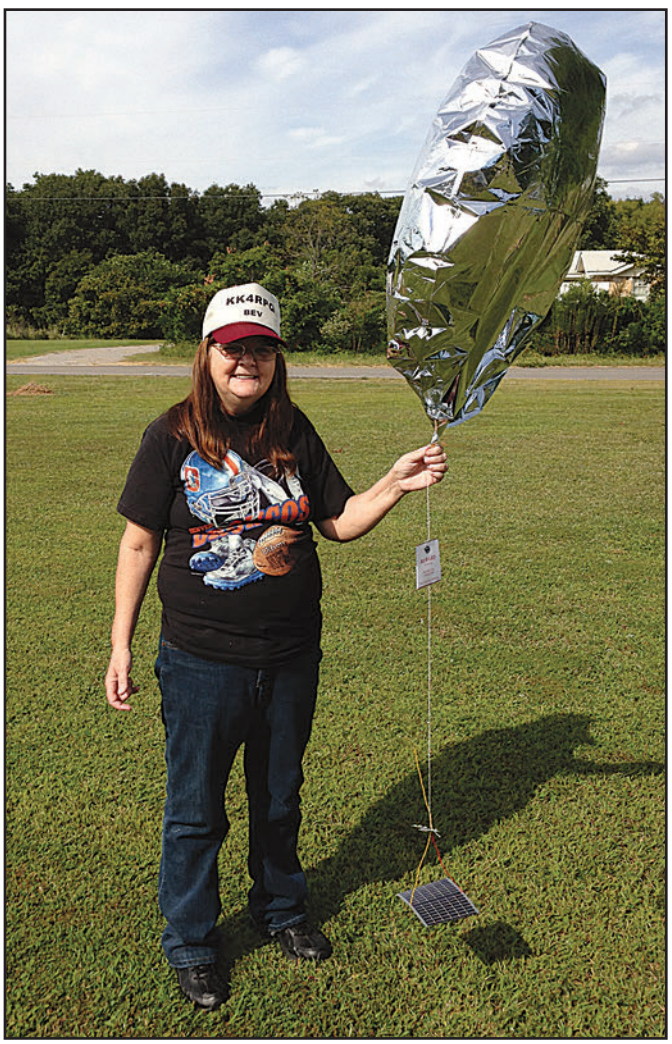

Photo 6. Bev Teter, KK4RPQ, launches the WB8ELK mylar balloon.

Photo 7. Greg Mann, KF4ZTI, copies the telemetry from the Vette City Hamfest foil balloon. (Photo by WB8ELK)

By Bob Witte,* KØNR

FM

FM/Repeaters—Inside Amateur Radio's "Utility" Mode

Summits On The Air with VHF

In the Spring 2013 issue of *CQ VHF*, I wrote about mountaintop VHF operating. Since then I've done some additional Summits On The Air (SOTA) activations, which I'll describe here. My intent is to provide some practical examples of how to get on the VHF SOTA.

Basic VHF Gear for SOTA

Most of the VHF SOTA activity in North America is on 2-meter FM, the *utility mode.* A VHF handheld transceiver really is a *trail friendly radio*, since you can just drop it in your backpack and go. Being a self-contained radio station, complete with power source and antenna, it is a handy way to get on the air. The cost is hard to beat as well, with low-cost radios starting at around $50.

The standard *rubber duck* is a very convenient antenna but represents a serious compromise in performance. I call this type of antenna *a very convenient crummy antenna.* A very effective upgrade is to use a half-wave vertical such as the MFJ-1714 or the Smiley Super Stick II. If you want a bigger signal, you can use a small Yagi antenna such as the Arrow 146-3. More on that later.

Another upgrade in efficiency is to use SSB or CW, using an all-mode rig such as the Yaesu FT-817. I've made a number of VHF SOTA contacts using CW/SSB and it makes a big difference in weak-signal performance.

Planning

The first step in activating a SOTA peak is doing some planning. For a well-known summit with an established trail, this can be really simple. For lesser known peaks, more extensive research may be required. My planning generally starts with the Sotawatch website, where I either check out a specific summit name (e.g., Pikes Peak) or review the map of SOTA peaks in a particular area of interest.

An example of a well-established trail to a SOTA summit is Devils Head Fire Lookout in Pike National Forest (WØ/FR-051). This summit has an excellent trail about 1.4 miles long to the base of the lookout tower (figure 1). The fire lookout is at 9748 feet elevation, which is about 1000 feet vertical gain above the trailhead (figure 2). This is a great SOTA hike, which I activated on 2-meter FM using a Yaesu FT-60 handheld radio and a 1/2-wave vertical antenna. The fire lookout at the top is an added attraction that makes the climb interesting.

Other peaks are not quite so well-known and may require a little bit of research. This is part of the fun of doing SOTA activations —identifying a summit and figuring out the best way to get to the top. A good example is Castle Rock in the South Park region of Colorado (WØ/SP-112). I looked up the summit

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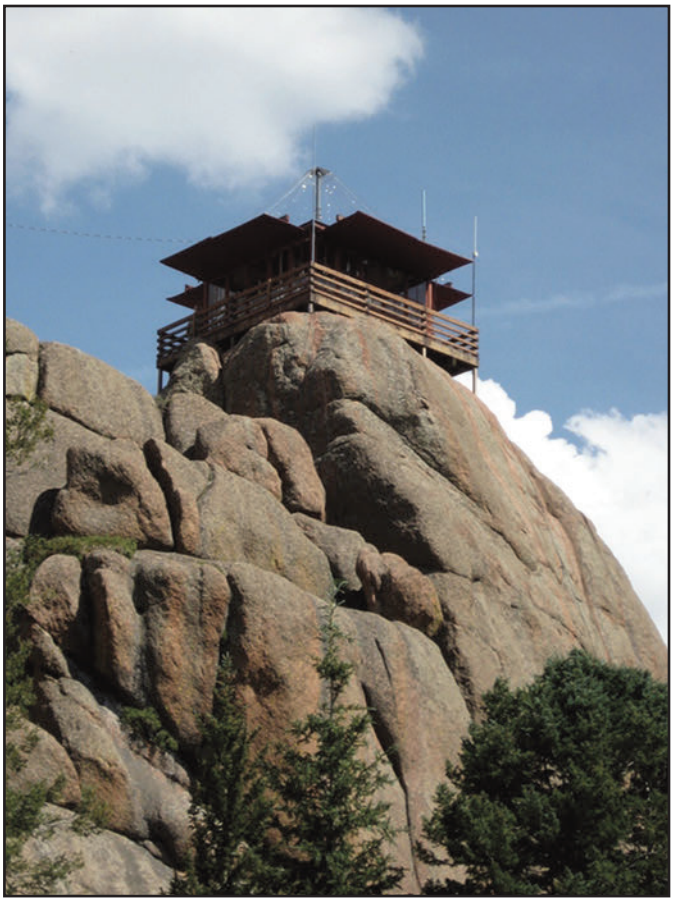

Figure 1. The Devils Head Fire Lookout is a SOTA peak and a popular hike in the Pike National Forest in Colorado.

Figure 2. The fire lookout is at an elevation of 9748 feet above sea level.

on SOTAwatch.org to get the basic information of latitude, longitude, and elevation and reviewed the SOTA Mapping Project map (figure 3). The SummitPost website provided some helpful information on the recommended route. This peak is very rugged at the top and I was not sure if it was a technical climb or not (figure 4). (It turns out that it is not technical, as long as you choose the route carefully.) I also consulted some topographical maps and a US Forest Service map to determine the best access roads and to verify the hiking route.

Make Some Calls

The next thing I do is get the word out that I will be activating a SOTA peak. Making VHF contacts in the backcountry is not always a sure thing, since many of the summits are quite remote and there may not be many radio amateurs within VHF range. I usually send out an e-mail notice to hams who are likely to be within range to give then a heads up that I'll be out hiking. Even if they are not active SOTA chasers, they usually enjoy making a contact with someone on a summit. I also post an *alert* on the SOTAwatch website indicating my operating plans.

When I reach the summit and if I have cell phone coverage, I put out a spot on SOTAwatch using the SOTA Goat iPhone app by Rockwell WW1X. (Yes, it is acceptable and encouraged to "self spot" your SOTA activation.) After that, I make a call on the simplex calling frequency, 146.52 MHz. It is always fun to see who responds to my call, since during the summer there often are campers, hikers, fishermen, and mobile stations listening on that frequency. On the other hand, sometimes it can be dead quiet and I get no response. It helps to have a little patience and keep calling. If that doesn't work, I try some other popular simplex frequencies. The last resort is keying up one of the local repeaters to see if anyone is listening there. It is OK to solicit a contact on a repeater, but you still need to make a simplex contact for SOTA credit. Of course, it is a good idea to have a repeater directory with you, or a list of the repeaters in the area.

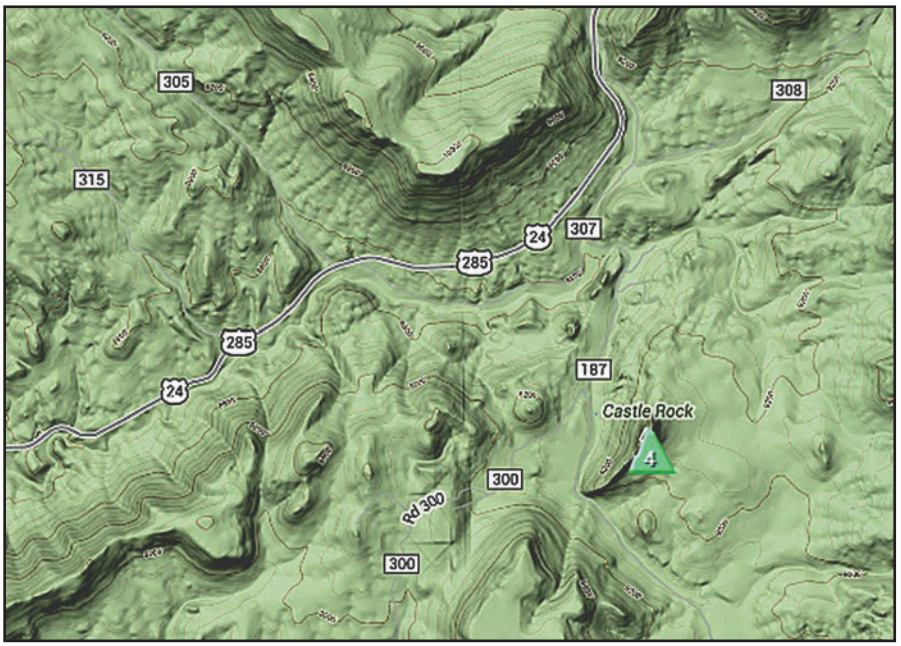

Figure 3. The SOTA Mapping Project offers excellent topographical maps of SOTA peaks.

Figure 4. Castle Rock is a prominent SOTA peak near Buena Vista, Colorado.

Figure 5. The highly innovative "HT on a rock" mounting technique.

SOTA peaks do not have to be strenuous hikes. In fact, you can operate from summits that have roads to the top as long as you do a *qualifying hike*. The basic idea is that it is acceptable to drive to the summit, but then you need to load up your gear and carry it down the mountain a bit and then back up. For example, this summer we had some visitors who wanted to drive to the summit of Pikes Peak. I decided this was an excellent opportunity to do a quick SOTA activation, so I took along my backpack and SOTA radio gear. After we arrived at the summit, I did a short hike down Barr Trail to lose, then gain, 100 feet of elevation (the SOTA guideline for the WØ region). The main idea is keep SOTA activations from being a sit-in-your-car-using-fossil-fuel mountaintop operation. Instead, your station has to

Figure 6. Bob, KØNR, assembles the 2-meter Arrow Yagi antenna.

Figure 7. The 3-element Yagi antenna easily breaks down into eight pieces for transport.

Figure 8. The Yagi antenna shown mounted on top of a trekking pole, using a 1/2-20 camera mount.

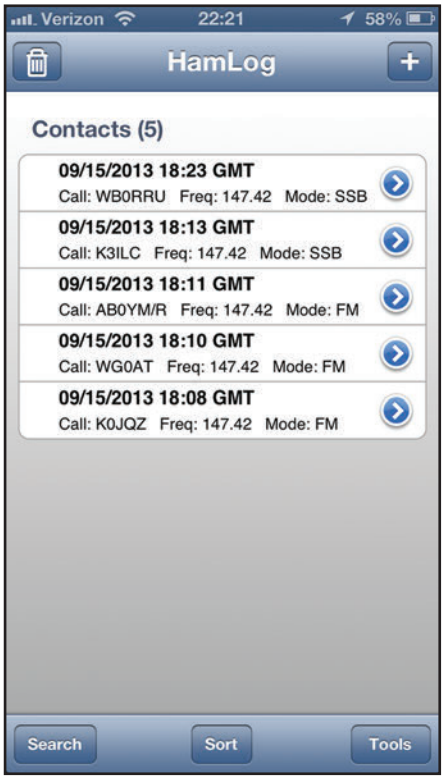

Figure 9. HamLog is a smartphone app logging program that is handy for portable operating.

be portable and carried some distance using non-motorized means.

Antennas

As mentioned earlier, the easiest 2-meter FM station is just an HT with a 1/2-wave vertical antenna (figure 5). This telescoping antenna is very convenient and sets up in an instant.

I recently picked up a 3-element Arrow Yagi antenna, the A146-3 (figure 6), for SOTA activations. I've always been a big fan of the dualband Arrow antenna, and this 2-meters-only antenna is a little smaller and more compact. I have the split-boom version which breaks down quite nicely and fits into a large daypack (figure 7). This antenna has a foam-covered handle that allows you to just grab and point the antenna. It also has threaded holes for attaching it to a standard camera tripod mount (1/4-20 thread). I usually mount it on top of a trekking pole that has a 1/4-20 mount, as shown in figure 8. This trekking pole is designed to be used as a camera monopod, but for SOTA use, it makes a handy mast for a Yagi antenna. It is *not* self-supporting and adds only a little bit of antenna height, but it provides a much easier way to handle the antenna.

Logging Contacts

If you are going to make SOTA contacts, you need to keep a log of them so you can enter them into the SOTA database later. The radio log can be quite simple, perhaps just a pencil and paper to jot down the basic logging information: callsign, time, frequency, and signal report. Alternatively, you can use a smartphone logging app such as HamLog for keeping track of your contacts (figure 9). HamLog includes a number of handy features such as grid location and is available on iOS and Android.

VHF Contests

VHF contests create some of the highest levels of activity on the VHF and up bands, so it is a great time to do some SOTA operating. For the ARRL September VHF Contest, I decided to do a simultaneous SOTA activation and VHF Contest effort. I hiked up Mount Herman (WØ/FR-063) on Sunday afternoon of the contest and handed out SOTA contacts while also working the contest. For the contest exchange, I gave out my grid locator (DM79), but I also let everyone know that I was on a SOTA peak.

For the ARRL contests, you'd probably want to enter in the *Single Operator – Portable* category, essentially the QRP category. For the CQ World-Wide VHF Contest in July, you also have the option of the *Hilltopper* category. This category is a perfect match with SOTA, since it uses QRP power levels but is limited to just six continuous hours of operating. You'll probably want to have an SSB transceiver along during a contest, since most of the activity will be on that mode. When working a VHF contest, you should *not* be spotting yourself using non-amateur means.

Tnx and 73

Thanks for taking the time to read another one of my columns on the *Utility Mode*. I always enjoy hearing from readers, so stop by my blog at <http://www.k0nr.com/blog> or drop me an e-mail.

73, Bob, KØNR

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Arrow Antenna: www.arrowantenna.com

By James Duffey,* KK6MC

BEGINNER'S GUIDE

All you need to know but were afraid to ask . . .

Improving Your Station – Moving Up from Loops

Many newcomers to the weak-signal world begin by using loop antennas, such as halos or squalos, particularly if they are moving to weak-signal communications from FM, where nearly everyone has an omnidirectional vertical. On first view, this seems a reasonable choice. Lots of people use loops, they are omnidirectional so you don't miss anyone by having the antenna pointed in the wrong direction, you don't need a rotor, and they are not a big investment. However, there are problems with loops, and as a result, many operators using them become frustrated. The magic of VHF weak-signal communication that they have heard about is not there. Why is this and what can you do about it?

The first problem with simple loops is the low gain. Recall that effective communication on VHF relies on good station capability in terms of good power, sensitive receive capability, low-loss feedline, low noise, and gain in the antenna. The omnidirectional pattern that attracts so many to the loop is also its biggest weakness. The omnidirectional pattern comes at the expense of gain. In an antenna, gain in one direction comes at the expense of gain in another direction. It is a zero sum game. In the case of a loop, to get the preferred pattern, one gives up gain in the direction you want to work for significantly reduced gain in all directions. While this may seem like a good trade in terms of being able to work everyone in a net or roundtable, in fact very little VHF communication is like this. For weak-signal work, you generally are working single stations, at a distance, and in many cases you know in what direction they are located. It is best to maximize your antenna resources in that direction. At about one dBi in free space, the loop has gain and performance below that of even a dipole.

The second big problem with loops is that although the signal you want to receive is in one direction, the noise received by the loop antenna can come from any direction. The omnidirectional antenna picks up the noise from all directions. Hence the signal-to-noise level can be quite high. With a gain antenna such as a Yagi pointed at the direction you want to work, you not only get the improvement in signal strength from the gain over a loop, but you also benefit from the directionality of the Yagi rejecting the noise in the directions you are not working. Depending on your location, the location of the station you are trying to work, and the location of the noise sources, one can get a much more significant signal-to-noise ratio improvement than what merely looking at the gain would suggest.

The third problem is probably cultural or psychological rather than technical, but many hams who put up loops also use inexpensive feed line, rationalizing that the good stuff is expensive and really only justified for big, that is high-gain, antenna installations. Nothing could be further from the truth. If anything, a low-gain antenna system can ill afford to give away any more signal, either on transmit or receive, than it has already given away in being low gain. Low-loss, high-quality feed line gives you benefits on both transmit and receive, and while it may seem expensive for a single time one off purchase, the cost is usually a small fraction of what the typical ham has invested in his station.

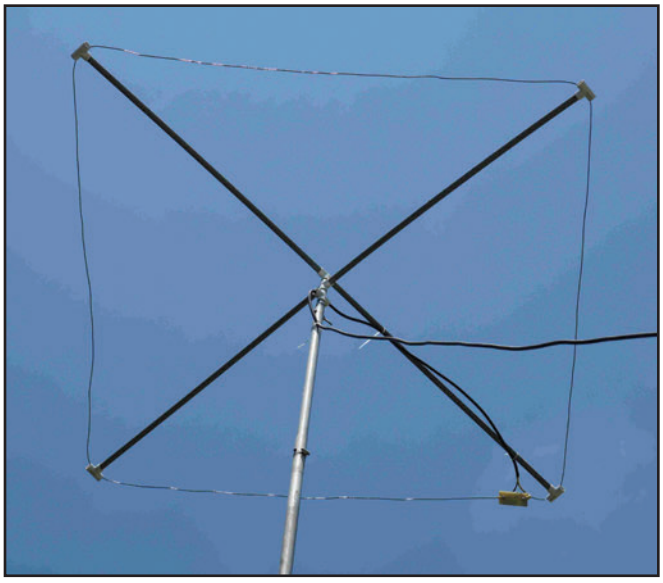

Photo 1. A homebrew 50-MHz loop. (Photo courtesy N6CL)

There are other problems with loops which are dependent on their construction and design. These include narrow bandwidth, tricky tuning, detuning with weather, some directionality, and feed-line radiation. Chances are if you have a loop you are familiar with one or more of these problems.

As a rover, I can usually work the stations running loops out to about 50 or 60 miles. After that they drop off significantly, and often, when I can hear them satisfactorily, they have trouble working me. Over time, several of these stations have upgraded from loops to gain antennas, and the difference in performance is amazing. I can consistently work them to distances of over 100 miles, and usually if one or the other of us can hear the other we can work each other. Most of these guys say that if they had known it would make such a difference they would have upgraded earlier.

Alternates to Loops

There are alternatives to loops that will give significantly better performance and don't cost much more, if any more, than a loop. Consider switching to them if you are running a loop.

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Dipole

A dipole, at 2.1 dBi gain, offers a slight gain improvement over a loop and some directionality. I suggest it as an alternative to a loop for the beginner as it has a wider bandwidth, is straightforward to tune, and can easily be fed directly with a choke balun and coax. It suffers many of the same maladies that a loop does, namely low gain and picking up noise from directions other than the one the station you are trying to work is located. If the loop is close to ground, which is usually the case on 6 meters and often the case on 2 meters, there will be some radiation off the ends of the dipole, albeit at higher angles, which at VHF translates to shorter ranges. The dipole can be pointed towards a direction that has a lot of activity, or arranged to be rotated by hand through 90 degrees to cover everyone. And best of all, it can be rotated by hand. But there may be better choices.

Moxon

A Moxon has 4 dB gain over a dipole and hence 5 dB over the usual loop. It can have sharp nulls off the back and sides to eliminate noise. It is easily fed with 50-ohm coax and can be built and put into operation with a minimum of tuning. Moxon antennas are easy to build and get operating with a minimum of fuss. For 6 meters, the N2MH design is good (http://www.n2mh.net/moxon. htm) and can be built from commonly available materials. A trip to your local home-improvement store and the local RadioShack will yield all of the material you need to build one. For 2 meters, the

Photo 2. Bob Reisenweber, W3BBO, had just finished building this antenna and has it temporarily set up on his lawn. (W3BBO photo courtesy N2MH)

Photo 3. A 3-element 50-MHz antenna. (Photo courtesy InnoVantennas)

DK7ZB Moxon design is good (http://www.qsl.net/d/dk7zb/Moxon/2-m-Moxon.htm) and again can be built after a trip to the local hardware store and RadioShack. A 222-MHz Moxon can be scaled from the 2-meter design. Just multiply all the dimensions by 145/223. The Moxon has a relatively wide bandwidth, is largely immune to detuning with weather, and is an all-around good performer. These antennas can easily be mounted on EMT (conduit), top rail, or pushup TV masts and turned with a small TV rotor such as the offerings from RadioShack or Channelmaster.

Commercial Moxons are available, but not in as large numbers as the loops and Yagis. PAR antennas makes a good 6-meter Moxon ideally suited for portable use, and a 2-meter one as well.

Stepping up to a Moxon from a loop will yield a big improvement to your station. You will immediately notice the difference in further range and generally better signal to noise.

Yagi

Yagis are available in a wide variety of designs, both commercial and homebrew. For 6 meters, you are probably better off with the Moxon than with a two- or three-element Yagi, but longer Yagis are much better performers, although the support structure is also more intensive, as these large antennas require bigger antenna supports (perhaps a tower) and bigger rotors. The two- and short three-element Yagis can be supported on a mast similar to the Moxon and turned with the same rotor.

For 2 meters and up, there is no question that the homebrew "Cheap Yagis" of WA5VJB, antennas columnist for this magazine (and for *CQ* magazine), offer the most bang for the buck. They can be built from easily obtainable material with hand tools, are inexpensive, and can be put on the air without tuning if reasonable care has been taken in their construction. See <http://www.wa5vjb.com/yagi-pdf/cheapyagi.pdf> for details. A 6-element two-meter design has 11 dBi or so gain on a 6-foot boom and will really open a new vista of VHF/UHF operating for those accustomed to loops. Kent has designs for the VHF/UHF bands up to 1296 MHz. If for whatever reason you can't swing a 6-foot antenna, Kent also has shorter designs that perform well for their length. All of the longer WA5VJB antennas can be supported on a simple mast and turned with a TV rotor. You will be pleasantly surprised by the bang for the buck these antennas offer and how much fun they are to build.

A variety of commercial Yagi designs are available as well, but I suggest you get your feet wet with Kent's designs before investing the money in a commercial design.

Photo 4. A 10-element 144-MHz antenna. (Photo courtesy N6CL)

Quads and Quagis

There are several quad designs available and these can be good performers. They are straightforward to build. Quads can be problematic to keep up, though, particularly if you have winters with freezing rain or summers with high winds. They also present more wind load, so a sturdier mast is necessary, and stacking more than one quad on a mast is difficult. If you want to go this route, VE7CA has information on building quads for 6 meters (http://www.ve7ca.net/AntSix.htm). For the higher bands, construction of a quad is usually more difficult than a WA5VJB Yagi, so it is hard to recommend them above 2 meters. If you want to go this route, though, N6NB has a design for a triband 2-meter/1.35-meter/70-cm quad that offers good performance.

Before the WA5VJB Yagis appeared, the easiest way to get on the VHF bands with gain was the quagi. These are still good-performing antennas on a longer boom than the WA5VJB, but there are better designs out there these days for the same boom length. Most newcomers will appreciate the ease of handling the shorter boom length WA5VJB antennas, but if you are looking to move up from a WA5VJB antenna to something with a bit more gain and can support it, but still

want to homebrew your antenna, look at the Quagis.

Improving Your Loop

If you feel that you must stay with a loop, there are several things you can do to improve performance. However, you should really try a gain antenna first.

Increase Height

Raising the height of your loop, even 10 feet or so, will help the antenna performace a great deal more than you would think. It will lower the angle of radiation, and troposcatter propagation depends strongly on the angle of radiation. It will also get your antenna up and farther away from local noise sources. Again, you can use EMT, top rail, or a TV mast to raise your antenna inexpensively.

Feedline

If you raise the antenna, you likely will have to replace your feedline. Replace it with a good-quality, low-loss feedline. Even if you don't raise your loop, if you are feeding that loop with RG58 or equivalent, you are giving away a lot of power and signal strength, particularly if your feedline run is long. While RG8X will do for short runs on 6 meters, it shouldn't be used for longer runs or on the higher bands. Consider nothing less than RG-213 or equivalent for 6 meters and 2 meters, and LMR400 or equivalent for 222 MHz and 432 MHz. Good feedline is not cheap, but it is an investment that will last a long time, so the cost amortized over the life of the feedline is low. Compare the price of your feedline to what you have invested in your station and you will see it is really a rather minor expense.

Other Loop Designs

The Big Wheel design offers an omnidirectional pattern with a gain roughly the equivalent of a dipole. It is rather more complicated to build and feed, but performance is less finicky and bandwidth much better than the typical loop. Commercial designs are available, although manufacturers tend to come and go and they are considerably more expensive than your typical loop. They occasionally can be found used at hamfests, though, so keep your eye out for them.

Stacking Loops

One can get some of the gain back from an omnidirectional antenna by stacking them two or more high. This requires the addition of phasing lines, which complicates things a bit. There are details in the *ARRL Handbook* and *ARRL Antenna Book* on constructing phasing lines, as well as on the web, so I won't go into detail on that here. You will need access to an antenna analyzer and the ability to measure accurately and repeatedly. You get a little less than 3 dB gain for two stacked loops, and a commensurate lowering of the radiation angle, so the benefit is less than going to a Yagi, but stacking will do nothing to improve the signal-to-noise ratio. The complexity of stacking loops is significantly more than just going to even a small Yagi, however.

Conclusion

I hope that I have convinced you of the merits of a directional antenna on VHF/UHF. It literally opens new horizons. Loops, while they can be a lot of fun, only offer a small glimpse of what VHF/UHF weak-signal propagation is capable of. Try a gain antenna!

73, James, KK6MC

By Keith Pugh,* W5IU

SATELLITES

Artificially Propagating Signals Through Space

Where We've Been and Where We're Going, Ham TV on the ISS, FUNcube, plus Thirty Years of Manned Amateur Radio in Space

Recent discussions on AMSAT-BB have indicated that a short amateur radio satellite history lesson would be appropriate this time around. This history lesson may provide some background for where we're going in the future, as well.

Also in this column, Ham TV is now on board the International Space Station (ISS) and commissioning is under way; FUNcube is complete and ready for launch—tentatively on 21 November 2013; and Owen Garriott, W5LFL, became the first amateur radio operator in space via the STS-9 in 1983.

Where We've Been and Where We're Going

Amateur radio satellites have been around since the launch of OSCAR-1, on 12 December 1961. In the 52 years since that time we have enjoyed launching and using approximately one hundred amateur radio satellites with various capabilities. This year also marks the 30th anniversary of amateur radio in manned space flight.

Orbital parameters have ranged from very Low Earth Orbit (LEO) to various High Earth Orbit (HEO) offerings. At very low altitudes the satellites are short lived unless re-boosted (like the ISS). Typical LEO satellites last a long time and provide varying capabilities depending upon modes available and the actual orbital altitude. For example, AO-07 was launched in 1974 and is still in use today as long as it is in sunlight. It is also a relatively high LEO satellite and provides great intercontinental DX capabilities. Most LEO birds are in moderate-altitude orbits that provide less DX but still very useful capabilities. We have satellites that provide beacon only, FM transponder, and linear (SSB/CW) transponder capabilities. We also have predominantly "digital" and "analog" satellites. Satellites have varying life spans and typically "die" when they lose power. Occasionally, even a HEO satellite (such as AO-13) actually decays and burns up during re-entry due to an unforeseen quirk in its orbital parameters.

Launches into these various orbits range from being thrown overboard from a space station (such as the ISS) to being separated from a geosynchronous transfer launch and then modified to the desired orbit by on-board propulsion systems. Most LEO satellites are separated from a low-altitude launcher by various means and then proceed on into their own orbits. As you can tell, there is a wide range of complexity involved in these launches. So far, only the HEO satellites have required an on-board propulsion system to get them from the temporary geosynchronous transfer orbit to a safe perigee altitude and on to their desired orbit. Recent and on-going advances in propulsion systems have made possible trade-offs between high-thrust, short-term (rocket motors) and low-thrust, long-term (ion propulsion) devices. However, some tasks (such as achieving a safe perigee altitude from a geosynchronous transfer launch) may still require a relatively high-thrust, high-energy device to be able to make the desired change in a short period of time.

All satellites require some form of orientation/stabilization capability to survive. First, they must have some way of establishing thermal equilibrium in the hostile environment of space. Without this capability, they literally will freeze on one side and bake on the other until they are destroyed by the environment. This can range from a simple bar magnet and differential photon pressure (black and white surfaces) to gravity gradient booms, magna-torquers, and complex heat-transfer equipment. If on-board propulsion is used, the attitude determination and control requirements become much more complex in order to keep the thrust directed in the correct direction to produce the desired orbital change. *Please keep in mind that all of the laws of physics must be satisfied.*

In the early days, the development of launchers was still in its infancy and AMSAT was able to obtain free or very inexpensive launches by being willing to take the risk of loss in return for a cheap ride as ballast to prove the launcher's "up mass" capability. In today's market, these rides no longer exist; even new launchers are usually mature enough that paying customers are available for the launches. In some ways, AMSAT has been its own worst enemy by pioneering the shared launch concept.

The CubeSat concept recently has become popular because today's technology makes it possible to put quite a bit of capability into a small volume space; however, there are limits to this. *Remember the laws of physics!* From a LEO orbit it is possible to provide communications with a very small and relatively simple satellite. Small amounts of power and simple antennas on the satellite coupled with relatively simple ground stations will provide satisfactory communications. As orbital altitude is increased to HEO, it becomes increasingly more difficult to maintain satisfactory communications between a simple satellite and an affordable ground station. At some point it becomes necessary to increase the effective radiated power from the satellite (and provide better receive capability on the satellite) in order to maintain communications with an affordable ground station—even as ground stations become more sophisti-

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cated. Modern techniques have permitted great advances in the state of the art, but nothing completely negates the need for large antennas on the ground, especially as satellite size decreases. Meanwhile, today's social environment limits the average ham's ability to have large antennas even if he can afford them.

Where am I headed with all of this? First, I'm sure most hams—especially those who have worked AO-10, AO-13, and AO-40—would love to have a good HEO satellite. Second, even though Phase 3E is sitting on a shelf in Germany nearly ready to go, it is not likely to get in HEO in today's market. AMSAT-DL and others continue to try to find an affordable launch for it, but so far "no joy."

Third, "bad mouthing" the AMSATs of the world for not providing a HEO satellite and backing out of the organizations will not help. Fourth, stay involved, keep up to date with the state of the art, and help solve the problem. Fifth, support AMSAT's LEO efforts (at the moment they are the only game in town). They can be very rewarding, especially if you become engaged in education and helping our youth become interested in science, technology, engineering, and math (STEM). This is our future—and we can have fun in the process.

Keep an open mind. If you're not careful, you can learn something every day. In the recent Phase 3 conversations on AMSAT-BB, I learned from Peter Gulzow, DB2OS, that we did have a solid propellant kick motor on at least one Phase 3 bird–Phase 3A, which now resides on the ocean floor off the coast of French Guiana. All of the other Phase 3 birds had "off the shelf" liquid fueled kick motors that performed their tasks well under the existing conditions. Popular opinion is that they all had major difficulties. Yes, there were difficulties but not necessarily with the kick motor itself.

If you haven't already thrown it away, keep your L-, S-, and X-band hardware from the AO-40 and AO-51 days. There are uses coming up in the near future, as we will see in the next segment of this column.

Ham TV on the ISS

Since the development of the Columbus Module for the ISS by the European Space Agency (ESA), ARISS has planned to add a video capability to the things ARISS can provide from the ISS. Columbus was launched with a combined L- and S-band antenna already installed. In recent months, a Digital Amateur Television (DATV) transmitter has been developed in Italy for use on the ISS. Recently it was deployed to the ISS on a cargo flight and it is now awaiting installation and checkout. The astronaut who will accomplish this will be launched to the ISS on 25 September 2013. By the time you read this, the ham TV module probably will be installed and at least be in the commissioning phase of activation.

Checkout of the initial ground stations slated to support this effort has already been accomplished in Europe and plans are in the works to develop a network of ground stations to provide support during some school contacts. These ground stations will be linked together with streaming video over the internet. Audio connections will be provided with the existing VHF and UHF capabilities. Requirements and plans for the ground stations, along with other information about ham TV, are included in bulletins posted by Gaston Bertels, ON4WF, to the ARISS-EU website: <http://www.ariss-eu.org>. The primary requirement for these ground stations is good S-band receive capability in addition to VHF, UHF, and broadband internet access. The intent is to expand this network of ground stations worldwide.

Remember the warning to keep your microwave equipment from above?

FUNcube

In previous editions of this column I have mentioned FUNcube, and it has always been in the future. Now it is real. As this is being written it is complete, has been checked out, and is loaded in its launcher in preparation for a launch now scheduled for 21 November 2013 aboard a Russian launcher.

You may remember the development of the FUNcube Dongle as the primary affordable ground station receiver for schools worldwide. Many of these, in at least two different versions, have been deployed to hams worldwide and a lot of SDR software has been written. Currently, ground station telemetry software is being written and checked out to support operations and education. This software will be ready for deployment by launch time. It will provide a capability to link telemetry via the internet similar to the network developed for ARISSat.

FUNcube will be in a sun synchronous polar orbit. It will be operated such that it provides educational access to schools during daytime passes and will provide a linear VHF/UHF transponder for ham use during nighttime passes. Latest status and operational details are available via the AMSAT-UK website: <http://amsat-uk.org/>. Let's get behind this one and make it a real success for STEM education in the schools and have some ham radio fun at the same time.

Thirty Years of Manned Amateur Radio in Space

On 28 November 1983 the Space Shuttle STS-9 mission was launched and Owen Garriott, W5LFL, became the first amateur radio operator to operate from Space. I remember well listening to and trying to contact Owen, but the "big guns" and the FM capture effect prevented me from working him. Nevertheless, I enjoyed listening to him and following his progress. He talked to many folks worldwide, including King Hussein of Jordan, JY1. A ceremony to commemorate this mission took place at the AMSAT Space Symposium in Houston, Texas, November 1–3, 2013.

Summary

Continue to operate on the "Birds" as much as possible. Use your equipment in all of its modes and on all of its frequencies. Attend the excellent Conferences and Symposiums dedicated to work in these areas. I hope you are planning to attend the AMSAT Space Symposium in Houston, TX, on November 1-3 year. I've been attending these functions since 1983 and never tire of them. I hope to see you there!

Please continue to support AMSAT's plans for the future of amateur radio satellites. There are new things happening every day. Refer to the newly redesigned AMSAT web page at <http://www.amsat.org> for details. This web page is still a "work in progress" as this is being written, but more functionality appears every day. Follow the projects and progress of AMSAT-UK at <http://www.amsat-uk.org/>.

Keep current with overall satellite status at: <http://www.dk3wn.info/p/?s=active+satellites&x=0&y=0>. Near real-time satellite status is available at: <http://oscar.dcarr.org/>.

'Til next time!

73, Keith, W5IU

CQ's 6 Meter and Satellite WAZ Awards

(As of October 1, 2013)

By Floyd Gerald,* N5FG, CQ WAZ Award Manager

6 Meter Worked All Zones

No.	Callsign	Zones needed to have all 40 confirmed
1	N4CH	16,17,18,19,20,21,22,23,24,25,26,28,29,34,39
2	N4MM	17,18,19,21,22,23,24,26,28,29,34
3	JI1CQA	2,18,34,40
4	K5UR	2,16,17,18,19,21,22,23,24,26,27,28,29,34,39
5	EH7KW	1,2,6,18,19,23
6	K6EID	17,18,19,21,22,23,24,26,28,29,34,39
7	KØFF	16,17,18,19,20,21,22,23,24,26,27,28,29,34
8	JF1IRW	2,40
9	K2ZD	2,16,17,18,19,21,22,23,24,26, 28,29,34
10	W4VHF	16,17,18,19,21,22,23,24,25,26,28,29,34,39
11	GØLCS	1,6,7,12,18,19,22,23,28,31
12	JR2AUE	2,18,34,40
13	K2MUB	16,17,18,19,21,22,23,24,26,28,29,34
14	AE4RO	16,17,18,19,21,22,23,24,26,28,29,34,37
15	DL3DXX	18,19,23,31,32
16	W5OZI	2,16,17,18,19,20,21,22,23,24,26,28,34,39,40
17	WA6PEV	3,4,16,17,18,19,20,21,22,23,24,26,29,34,39
18	9A8A	1,2,3,6,7,10,12,18,19,23,31
19	9A3JI	1,2,3,4,6,7,10,12,18,19,23,26,29,31,32
20	SP5EWY	1,2,3,4,6,9,10,12,18,19,23,26,31,32
21	W8PAT	16,17,18,19,20,21,22,23,24,26,28,29,30,34,39
22	K4CKS	16,17,18,19,21,22,23,24,26,28,29,34,36,39
23	HB9RUZ	1,2,3,6,7,9,10,18,19,23,31,32
24	JA3IW	2,5,18,34,40
25	IK1GPG	1,2,3,6,10,12,18,19,23,32
26	W1AIM	16,17,18,19,20,21,22,23,24,26,28,29,30,34
27	K1LPS	16,17,18,19,21,22,23,24,26,27,28,29,30,34,37
28	W3NZL	17,18,19,21,22,23,24,26,27,28,29,34
29	K1AE	2,16,17,18,19,21,22,23,24,25,26,28,29,34,36
30	IW9CER	1,2,6,18,19,23,26,29,32
31	IT9IPQ	1,2,3,6,18,19,23,26,29,32
32	G4BWP	1,2,3,6,12,18,19,22,23,24,30,31,32
33	LZ2CC	1
34	K6MIO/KH6	16,17,18,19,23,26,34,35,37,40
35	K3KYR	17,18,19,21,22,23,24,25,26,28,29,30,34
36	YV1DIG	1,2,17,18,19,21,23,24,26,27,29,34,40
37	KØAZ	16,17,18,19,21,22,23,24,26,28,29,34,39
38	WB8XX	17,18,19,21,22,23,24,26,28,29,34,37,39
39	K1MS	2,17,18,19,21,22,23,24,25,26,28,29,30,34
40	ES2RJ	1,2,3,10,12,13,19,23,32,39
41	NW5E	17,18,19,21,22,23,24,26,27,28,29,30,34,37,39
42	ON4AOI	1,18,19,23,32
43	N3DB	17,18,19,21,22,23,24,25,26,27,28,29,30,34,36
44	K4ZOO	2,16,17,18,19,21,22,23,24,25,26,27,28,29,34
45	G3VOF	1,3,12,18,19,23,28,29,31,32
46	ES2WX	1,2,3,10,12,13,19,31,32,39
47	IW2CAM	1,2,3,6,9,10,12,18,19,22,23,27,28,29,32
48	OE4WHG	1,2,3,6,7,10,12,13,18,19,23,28,32,40
49	TI5KD	2,17,18,19,21,22,23,26,27,34,35,37,38,39
50	W9RPM	2,17,18,19,21,22,23,24,26,29,34,37
51	N8KOL	17,18,19,21,22,23,24,26,28,29,30,34,35,39
52	K2YOF	17,18,19,21,22,23,24,25,26,28,29,30,32,34
53	WA1ECF	17,18,19,21,23,24,25,26,27,28,29,30,34,36
54	W4TJ	17,18,19,21,22,23,24,25,26,27,28,29,34,39
55	JM1SZY	2,18,34,40
56	SM6FHZ	1,2,3,6,12,18,19,23,31,32
57	N6KK	15,16,17,18,19,20,21,22,23,24,34,35,37,38,40
58	NH7RO	1,2,17,18,19,21,22,23,28,34,35,37,38,39,40
59	OK1MP	1,2,3,10,13,18,19,23,28,32
60	W9JUV	2,17,18,19,21,22,23,24,26,28,29,30,34
61	K9AB	2,16,17,18,19,21,22,23,24,26,28,29,30,34
62	W2MPK	2,12,17,18,19,21,22,23,24,26,28,29,30,34,36
63	K3XA	17,18,19,21,22,23,24,25,26,27,28,29,30,34,36
64	KB4CRT	2,17,18,19,21,22,23,24,26,28,29,34,36,37,39
65	JH7IFR	2,5,9,10,18,23,34,36,38,40
66	KØSQ	16,17,18,19,20,21,22,23,24,26,28,29,34
67	W3TC	17,18,19,21,22,23,24,26,28,29,30,34
68	IKØPEA	1,2,3,6,7,10,18,19,22,23,26,28,29,31,32
69	W4UDH	16,17,18,19,21,22,23,24,26,27,28,29,30,34,39
70	VR2XMT	2,5,6,9,18,23,40
71	EH9IB	1,2,3,6,10,17,18,19,23,27,28
72	K4MQG	17,18,19,21,22,23,24,25,26,28,29,30,34,39
73	JF6EZY	2,4,5,6,9,19,34,35,36,40
74	VE1YX	17,18,19,23,24,26,28,29,30,34
75	OK1VBN	1,2,3,6,7,10,12,18,19,22,23,24,32,34
76	UT7QF	1,2,3,6,10,12,13,19,24,26,30,31
77	K5NA	16,17,18,19,21,22,23,24,26,28,29,33,37,39
78	I4EAT	1,2,6,10,18,19,23,32
79	W3BTX	17,18,19,22,23,26,34,38
80	JH1HHC	2,5,7,9,18,34,35,37,40.
81	PY2RO	1,2,17,184OM,19,21,22,23,26,28,29,30,38,39,40
82	W4UM	18,19,21,22,23,24,26,27,28,29,34,37,39
83	I5KG	1,2,3,6,10,18,19,23,27,29,32.
84	DF3CB	1,18,19,32
85	K4PI	17,18,19,21,22,23,24,26,28,29,30,34,37,38,39.
86	WB8TGY	16,17,18,19,21,22,23,24,26,28,29,30,34,36,39
87	MUØFAL	1,2,12,18,19,22,23,24,26,27,28,29,30,31,32
88	PY2BW	1,2,17,18,19,22,23,26,28,29,30,38,39,40.
89	K4OM	17,18,19,21,22,23,24,26,28,29,32,34,36,38,39.
90	JHØBBE	33,34,40
91	K6QXY	17,18,19,21,22,23,34,37,39
92	JA8ISU	2,7,8,9,19,33,34,36,37,38,39,40
93	YO9HP	1,2,6,7,11,12,13,18,19,23,28,29,30,31,40
94	SV8CS	1,2,18,19,29
95	SM3NRY	1,6,10,12,13,19,23,25,26,29,30,31,32,39
96	VK3OT	2,10,11,12,16,34,35,37,39,40
97	UY1HY	1,2,3,6,7,9,12,18,19,23,26,28,31,32,36
98	JA7QVI	2,40
99	K1HTV	17,18,19,21,22,23,24,26,28,29,34
100	OK1RD	2,7,8,9,11,13,18,19,21,22,28,39,40
101	S51DI	1,2,6,18,19
102	S59Z	1,2,6,7,10,12,17,18,19,22,23,24,26,31,32
103	UY5ZZ	1,2,3,6,7,10,11,12,13,18,19,29,31,32,39
104	UXØFF	1,2,6,7,10,12,13,18,19,22,28,29,31,32
105	EI3IO	1,3,12,18,19,23,29,30,31,32
106	JJ2BLV	2,4,5,7,8,9,16,18,19,34,35,36,37,38,40
107	EA6SX	1,2,10,12,18,19,22,26,27,28,29,30,31,32.
108	PE5T	1,2,3,6,12,18,19,22,27,29,30,31,32,39
109	SP3RNZ	1,2,3,6,7,13,18,19,23,24,26,28,31,32
110	W9VHF	17,18,19,21,22,23,24,26,28,29,30,34,36,39
111	UT5URW	1,2,3,4,6,7,10,11,12,18,19,29,30,31,32
112	KR7O	18,19,21,22,23,26,28,33,34,35,36,37,39,40
113	K8SIX	19,13,17,18,19,21,22,23,24,26,29,30,34,37
114	K7CW	16,18,19,21,22,23,24,26,28,33,34,35,36,37,39
115	SP3E	1,2,6,7,10,12,13,18,19,22,27,29,30,31,32
116	UT9FJ	1,2,3,4,5,6,7,10,11,18,19,23,30,31,32

Satellite Worked All Zones

No.	Callsign	Issue date	Zones Needed to have all 40 confirmed
1	KL7GRF	8 Mar. 93	None
2	VE6LQ	31 Mar. 93	None
3	KD6PY	1 June 93	None
4	OH5LK	23 June 93	None
5	AA6PJ	21 July 93	None
6	K7HDK	9 Sept. 93	None
7	W1NU	13 Oct. 93	None
8	DC8TS	29 Oct. 93	None
9	DG2SBW	12 Jan. 94	None
10	N4SU	20 Jan. 94	None
11	PAØAND	17 Feb. 94	None
12	VE3NPC	16 Mar. 94	None
13	WB4MLE	31 Mar. 94	None
14	OE3JIS	28 Feb. 95	None
15	JA1BLC	10 Apr. 97	None
16	F5ETM	30 Oct. 97	None
17	KE4SCY	15 Apr. 01	10,18,19,22,23, 24,26,27,28, 29,34,35,37,39
18	N6KK	15 Dec. 02	None
19	DL2AYK	7 May 03	2,10,19,29,34
20	N1HOQ	31 Jan. 04	10,13,18,19,23, 24,26,27,28,29, 33,34,36,37,39
21	AA6NP	12 Feb. 04	None
22	9V1XE	14 Aug. 04	2,5,7,8,9,10,12,13, 23,34,35,36,37,40
23	VR2XMT	01 May 06	2,5,8,9,10,11,12,13,23,34,40
24	XE1MEX	19 Mar. 09	2,17,18,21,22,23,26,34,37,40
25	KCØTO	17 Mar. 11	None
26	TI5RLI	10 July 12	2,16,19,22,23,24,26,34

CQ offers the Satellite Work All Zones award for stations who confirm a minimum of 25 zones worked via amateur radio satellite. In 2001 we "lowered the bar" from the original 40 zone requirement to encourage participation in this very difficult award. A Satellite WAZ certificate will indicate the number of zones that are confirmed when the applicant first applies for the award.

Endorsement stickers are not offered for this award. However, an embossed, gold seal will be issued to you when you finally confirm that last zone.

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to the WAZ Award Manager: Floyd Gerald, N5FG, P.O. Box 449, Wiggins, MS 39577-0449. The processing fee for all CQ awards is $6.00 for subscribers (please include your most recent *CQ* or *CQ VHF* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to Floyd Gerald. Applicants sending QSL cards to a CQ Checkpoint or the Award Manager must include return postage. N5FG may also be reached via e-mail: <n5fg@cq-amateur-radio.com>.

*P.O. Box 449, Wiggins, MS 39577-0449; e-mail: <n5fg@cq-amateur-radio.com>

By Joe Moell,* KØOV

HOMING IN

Radio Direction Finding for Fun and Public Service

Two Unusual Interference Cases and a Shrunken 6-meter Quad

The Terminal Building is a downtown landmark in Lincoln, Nebraska. It was built in 1916 for offices of the Lincoln Traction Company, which operated the city's largest streetcar system. When buses replaced the last of the streetcars in 1943, the building continued to thrive as the home of businesses, law firms, and the popular Terminal Drug soda fountain.

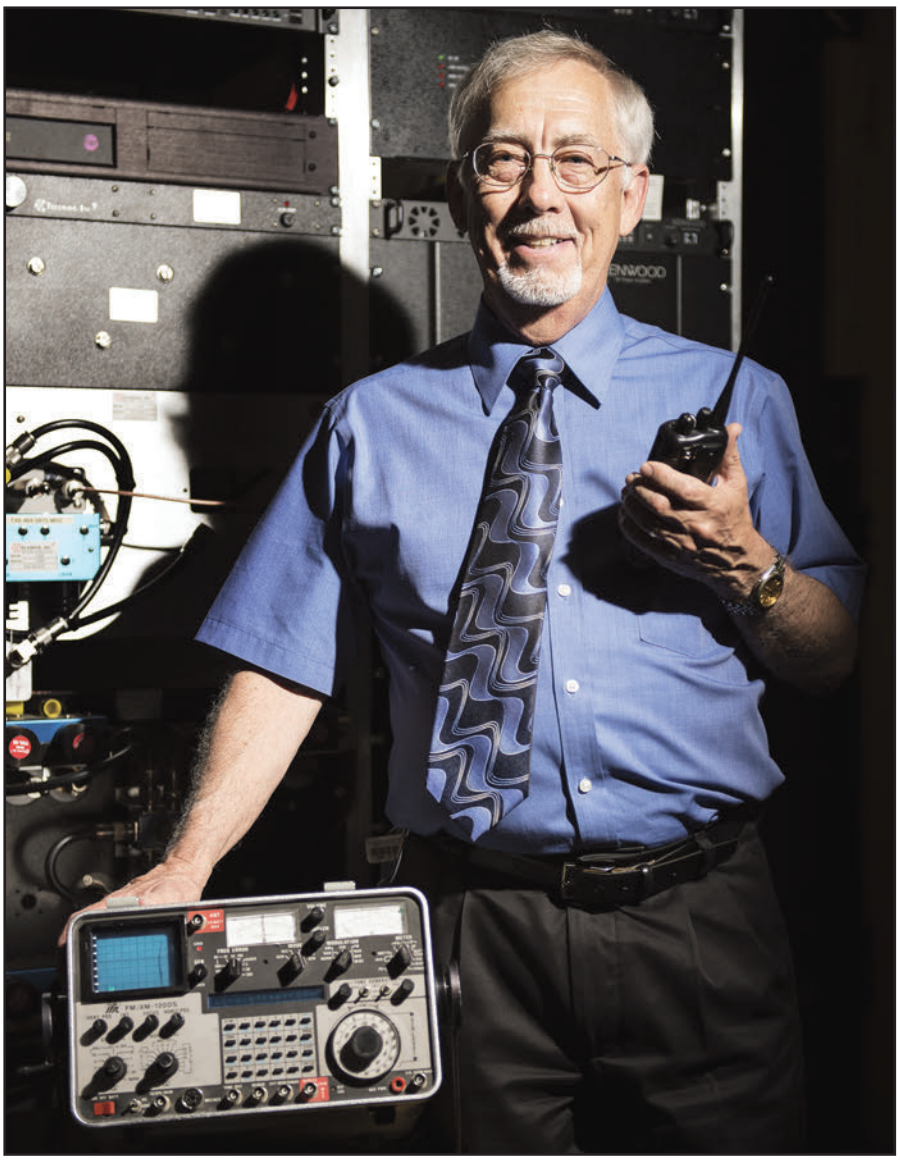
In 1967, I was the engineer of a struggling 1000-watt FM radio station on the top floor of the Terminal Building. Every hour, we followed the station ID with a proclamation that our studios and offices were in "Lincoln's Prestige Office Building," which got us a discount on the rent. With visions of increasing our coverage to include Omaha and all the little towns in between, I prepared an FCC application to QSY the station to a newly available Class C frequency and raise our effective radiated power to 134 kilowatts.

Achieving this ERP would require a 16-element antenna array. For the center of radiation to be 62 feet above the elevator penthouse, the array would have to go on a tower more than twice that height. Structural experts assured me that it was practical and safe to install a 125-foot guyed tower holding 1400 pounds of antenna and coax on the 80×140-foot roof of a 125-foot high brick building. I filed the application and crossed my fingers.

The FCC eventually granted a construction permit, but by then I had left Lincoln to seek my fortune in California. Amazingly, the high-power transmission facility was built and went on the air with only a few changes. According to Roger Agnew, K1KQ, son of the station's owner, "The entire tower was assembled; the big ERI[1] antenna was mounted onto it on the ground along 'O' Street early one Sunday morning. Then the whole assembly was lifted up to its base on the roof by a big helicopter. The helo hovered while everything was bolted and guyed in place."

That radio station has been absent from the Terminal Building for 30 years, but the tower remains as an important communications hub for the entire city. One of its tenants is Shaffer Communications,[2] owned by Paul Babl, KBØVUH. His commercial two-way UHF repeaters serve customers in health care, agribusiness, and government.

Paul says, "Besides the Terminal Building, we have a site in Beatrice and another near the Missouri River, all



Paul Babl, KBØVUH, with his radio systems atop the Terminal Building. (Photo by Kristin Streff, Lincoln Journal-Star*)*

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linked together so we have coverage from the south part of Council Bluffs to the state line south of Wymore. In the last 2 1/2 years, we've undergone the busiest time since I have been in the radio industry because all of our systems had to be narrowbanded to meet new FCC regulations."

In early May, Paul's customers began complaining of poor radio system performance. Locations that formerly were solid were now noisy. Communications "holes" popped up all over the city. Paul's service monitor showed that the noise floor in all of his Terminal Building receivers had increased by 30 dB, enough to drastically reduce his system's range.

What had changed? Ancient DC motors for the Terminal Building elevators had just been replaced. Cellular systems on the roof had just been upgraded. Both were carefully checked and cleared as possible causes. Cables in Shaffer's antenna systems on the big tower were not damaged or degraded.

KBØVUH had chased interference problems before, but never a broadband source like this. So he sought assistance from NCEE Labs,[3] a top-notch environmental and electromagnetic compatibility testing facility in the Highlands area of Lincoln. Working together, they determined that the noise source was not atop the Terminal Building, but was coming from the southeast.

NCEE techs filled a van with equipment and headed east, hoping to pick up a signal that they could triangulate against the southeast bearing to pinpoint the noise source. "It was a Friday," Paul told me. "We couldn't find any place to the east where we heard the noise. It got to be 6 PM, so I let them go home. I carried on from there on Saturday and Sunday, looking all over town with no luck. Then returning from the south side, I started to detect the noise on my service monitor. I realized later that I was pretty lucky coming through town at just the right place."

Paul guessed that it was coming from a cellular system, or perhaps cable TV lines. But as he got closer and the signal got stronger, he realized that it was probably coming from a point source. He kept at it and eventually narrowed it down to a couple of houses. "Next time, one of my friends who's a ham in the two-way radio business came with me. He had heard that you can put a paper clip into the antenna connector of a radio and use it to 'sniff' up close for signals and he wanted to try it. We got right down in between the apartment buildings. Then, suddenly, it was gone."

This shrunken quad has proven to be a sensitive and effective RDF antenna for 6 meters. The taped-up corners were field repairs for broken spreader tip dowels. Next time, fiberglass spreaders! (Photo by Joe Moell, KØOV)

The noise was back next morning, so Paul printed up some notices to put on every door in the neighborhood. "The notice was very non-accusatory," he said. "It stated that there is a transmitter in this neighborhood that is affecting important communications in downtown Lincoln. The fines for interfering with a legal transmitter are very large. If you know anything about this, call me at this number or see that it is shut down."

After the notice failed to produce results, KBØVUH enlisted help from the apartment buildings' landlord. With his technicians standing by in his truck and atop the Terminal Building, they removed fuses serving the units, one by one. "It was so amazing when the landowner removed the fifth fuse," Paul exclaims. "I heard a bunch of yelling from my back seat and also from the guy downtown. It was like 6-year old kids at Christmas.

"On the next business day, I called the FCC office in Kansas City. Two of their agents were on the way back from western Nebraska and would be taking the interstate through Lincoln. They visited the apartment and found two foreign-made broadband jamming devices, one for GPS frequencies and the other for UHF, covering 450 to 485 MHz. The agents did not seize the devices, but told their owner in no uncertain terms that they were illegal and he would have to make sure that they were never plugged in."

According to an article in the *Lincoln Journal-Star* newspaper, the jammers were in the possession of a 39-year-old man with a history of depression and paranoia. Two years earlier, the man had filed suit against two hospitals, alleging that doctors there had implanted a GPS tracking device in his armpit during tonsil and sinus surgery. After the suit was dismissed as frivolous, he bought the jammers to keep anyone from tracking him.

Paul relates the end of the story: "About three or four days later, it was back on again, so I stopped in at the Lincoln Police Department. One officer was very understanding. He told me, 'It's like that guy has his hand around the throat of your business and your livelihood.' That officer talked to the guy and told him that if the jammer was heard again, he would be arrested. As far as I know, it has not been on since."

TV Invades 6 Meters

My 6-meter transmitter hunting experiences paid off recently when a ham in my county reported a strange signal that slow-

ly wandered between 50.100 and 50.150 MHz. With his receiver in FM mode, he could hear distorted audio of television shows. The signal was S9 + 20 dB on his receiver, making 6-meter DXing impossible for him. It wasn't present 24 hours a day, but it was on for a few hours almost every afternoon or evening.

My first suspicion in situations like this is that the source is something in the ham's own home. TV receiving devices such as cable boxes, fiber modems, and digital TV converters have outputs on TV channels 3 and 4, so perhaps one of those devices had a spurious emission.

From my car in front of his house, I could hear the signal on my 6-meter set. But as I drove by his nearby neighbors, the signal strength did not fall off quickly, as would be expected if the source were within his house. I also noticed that the TV audio did not correlate with any programs being broadcast at that time. The shows did not start and stop on the hour or half-hour. There were no commercials, but there were occasional long periods of dead carrier.

I guessed that someone in the neighborhood was playing back recorded shows on a DVR and fast-forwarding or muting during the commercials. The affected ham and I might be hearing a spur from the modulator in the DVR output. In that case, there should be a video carrier 4.5 MHz below the audio, but I tuned for it and there was none.

It was time for a mobile 6-meter directional antenna. I had the perfect choice hanging in my garage. It was a "shrunken" two-element quad tuned to 50.3 MHz, the frequency of the Southern California Six Meter Club transmitter hunts that took place monthly in the 1990s. A shrunken quad[4] has element circumferences that are about half of their counterparts in a full-size cubical quad. The elements are tuned with capacitance between the voltage peaks along their circumferences.

A shrunken quad has less gain than a full-size quad, but its directional pattern is very good. I won my share of hunts with it because its large capture area helped me copy weak hidden transmitters that hunters with fractional-wavelength loops couldn't hear.

Next day when I went to the affected area, the quad was atop my van roof. Fortunately, the spurious signal was present. It didn't take long to follow it about two blocks away, where it became very strong in front of three homes. None of the three had amateur radio antennas. From the amount of attenuation and the S-meter reading, I determined that the signal into my receiver was 300 microvolts in front of the middle house.

Just as I thought that the job was done, I noticed that there was a row of new homes directly behind the three in question. The slowly changing bearings as I drove past the row of three told me that the source might actually be in one of the new homes. Unfortunately, when I got there, the signal had disappeared.

Clearly this interference was not from an amateur radio source and it exceeded FCC Part 15 limits. It was time to call in the authorities. I wrote a detailed summary of my findings, with maps, and sent it to the local FCC office. It took several weeks, but eventually the affected ham reported that the interference had disappeared.

I haven't been told what the source of the interference turned out to be, but because it was so strong, I suspect a defective 49-MHz wireless headphone set. Surprisingly, some of these imported devices use simple LC oscillators, not crystal control. It's not hard to imagine one wandering up into the 6-meter band.

Matthew Robbins AA9YH (closest) and Joseph Huberman K5JGH at the start of a training session just before last year's ARDF Championships near Mt. Laguna. The hills just behind them burned during the Chariot Fire in July. (Photo by Joe Moell, K0OV)

Build this Quad

You can duplicate my 6-meter shrunken quad and perhaps win some 6-meter transmitter hunts by following the details in figure 1. Schedule 40 PVC pipe (thick wall) is suitable for the mast and boom. I used wooden dowel rod for the spreaders and AWG 18 enamel-covered solid wire for the elements on my experimental

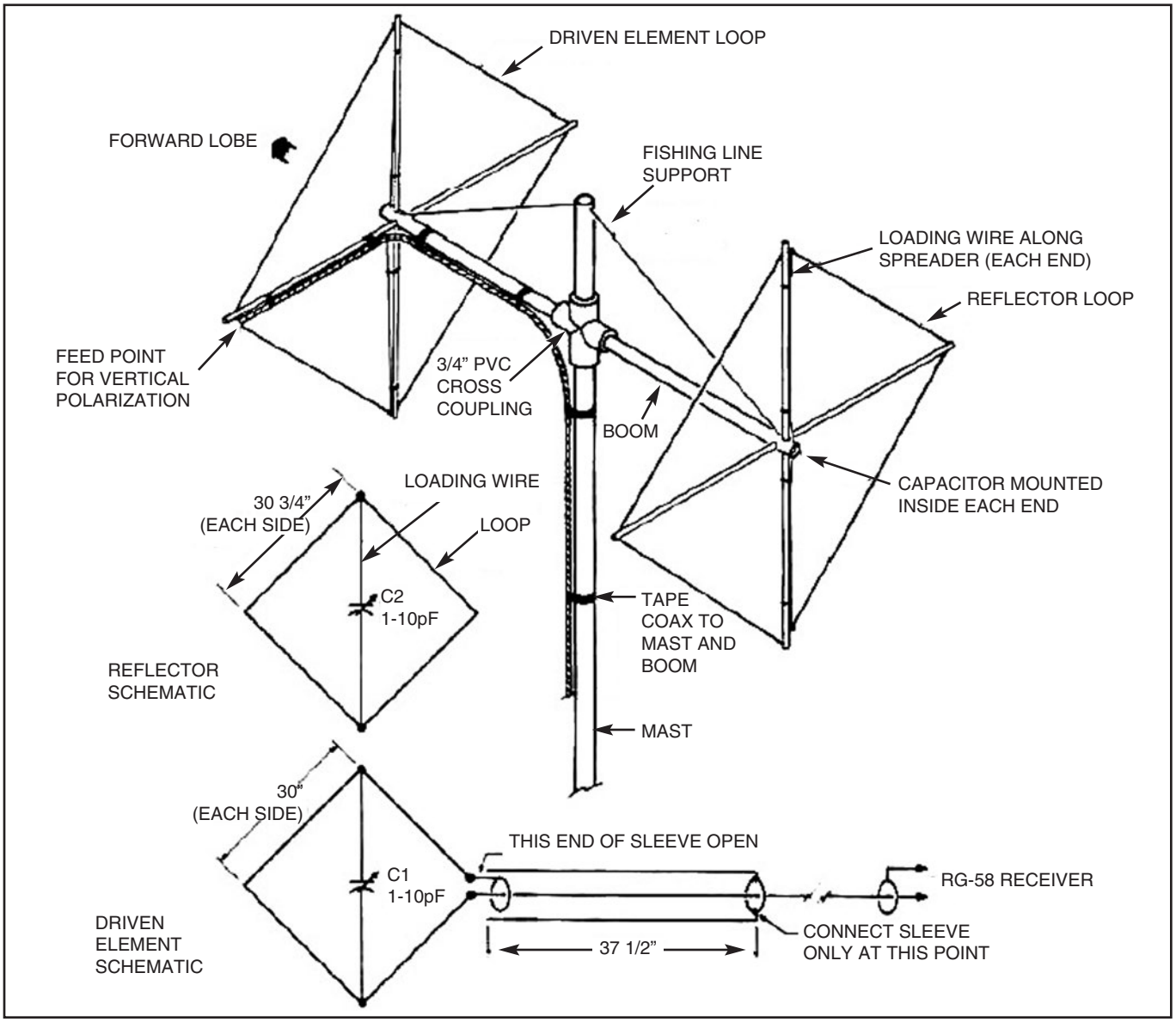

Figure 1. Construction details for the 6-meter shrunken quad. See text for additional information.

model. If I were building another, I would choose fiberglass rod spreaders and copperweld wire to make it more rugged.

The two capacitors are miniature piston trimmers. Don't use air variables, because dirt and moisture on them will upset the critical tuning of the elements. Also, don't choose the inexpensive trimmers that have an open ceramic tube about a half inch long with plating on inside and outside and a screw with coarse thread. The correct ones are about 1/4 inch in diameter and 1/2 inch long, completely enclosed in ceramic and brass. They have a constant-torque drive with very fine thread. It takes 11 turns of the tuning tool to cover the full capacitance range on the ones I used. The piston and bellows are internal and the whole thing is sealed, so moisture won't upset the tuning. A good choice would be Sprague Goodman part GAA10004, available from Mouser Electronics. [5]

Cut a 22 1/4-inch PVC pipe for the driven element half of the boom and a 26 1/4-inch pipe for the reflector side. Drill holes at right angles for the spreaders, being sure to space the holes so that the spreaders are just touching inside the boom. The point of contact of spreaders is 1 inch from each end. This gives 48 1/4-inch element spacing and proper balance when the two boom pieces are fitted into the 3/4-inch PVC slip-type cross fitting.

Cut the spreaders to 43 inches long for the driven element and 44 inches for the reflector. Drill small holes in the spreaders 1/4 inch from each end for the element wire. When assembled, the driven-element wire circumference is 120 inches and the reflector circumference is 123 inches. Carefully distribute the wire between the spreaders so that the four quarter-wavelength spans of each element are equal in length.

Next, add the loading wires and capacitors as shown. For ruggedness, drill small holes in the ends of the boom for the loading wires, and secure the trimmer capacitors inside the ends of the boom. Orient the capacitors so that they can be adjusted with a screwdriver from below. Complete the assembly by installing a 10-inch mast extension on top, with taut nylon fishing-line supports to keep the boom from flopping up and down along the road.

Bolt the two boom pieces into the PVC cross fitting to allow disassembly for storage and transport. I secured everything else with hot-melt glue to allow further experimentation and changes. Lace the loading wires securely to the spreaders and tape the RG-58 feed line to the mast and boom.

The balun minimizes distortion of the directional pattern by the feedline. The sleeve is a length of braid from an old piece of coax. Make a small cut in the coax jacket 37-1/2 inches from the driven element end to expose the braid. Connect the added sleeve to the coax braid at this point and smooth it out over the jacket. Cut it off a quarter inch from the driven element end, making sure it does not contact the RG-58 feedline shield at that point. Put tape over the ends of the sleeve to keep it in place and prevent shorts.

Even though it is "shrunken," this antenna is too large to mount on a mast through a vehicle side window. You would be inviting a ticket for "excessive overhang." If you don't want to drill a hole for the mast through the roof, then mount it in the bed of a pickup or through a sun roof.

The antenna as shown is for vertical polarization. The diamond orientation minimizes detuning caused by interaction with the vehicle roof. For horizontal polarization, rotate each element 90 degrees. The feedline will then be at the bottom corner.

Tuning It Up

This antenna is not designed for transmitting, so don't try to tune it with a bridge, wattmeter, or SWR indicator. Instead, connect it to a receiver with S-meter and use a separate transmitter or signal generator as a signal source. Keep the source power low or use an RF attenuator in line with the receiver so that the S-meter stays in range.

A loaded antenna such as this has a high Q. Its bandwidth for good directivity is about one-half percent, so tune the antenna at the exact hunt frequency. The test transmitter antenna should have the same polarization as the shrunken quad and it's best if it is at least 50 feet away. Mount the quad on your vehicle as it will be used for hunting. The vehicle and source should be in the clear, away from large objects such as houses, trees, power lines, and other vehicles.

Begin tuning by removing the reflector from the PVC cross and set it aside. Aim the antenna at the signal source and tune trimmer C1 for a peak on the S-meter. Hand capacitance will affect the adjustments, so overtune if necessary and always move your hand away to check results. Next, put the reflector back on the quad, point the antenna away from the source, and carefully tune C2 for a null on the S-meter. Turn the quad back toward the source and re-peak C1, without removing the reflector this time. Repeat the sequence as necessary until no further improvement is seen.

A coax switch and a whip antenna should be included in your setup if you need to be able to transmit. A quarter-wavelength vertical on the side of my van does not affect performance of the shrunken quad. Include an RF attenuator between the quad and receiver to knock down the signal as you close in and the S-meter pins.

Fires Threaten ARDF Sites

For the second time, a California radio-orienteering venue has been severely threatened by wildfire. Just after noon on Saturday, July 6, a blaze broke out on the floor of the Anza-Borrego Desert just west of Highway S2, also known as the Great Overland Stage Route of 1849. In the 19th century, this was a trail that was taken westward by many famous people, including Kit Carson and Mark Twain. Since paving was completed in 1961, it has become a gateway to desert recreation.

Winds pushed the Chariot Fire westward up the eastern slopes of Monument Peak and then down toward the Mt. Laguna Recreation Area. By the time it was extinguished on July 15, more than 7000 acres had been burned and over 150 structures were destroyed or damaged. The worst devastation took place at the Al Bahr Shrine Camp, where the lodge, dining hall, and over 100 cabins were consumed. That camp and about 200 acres of burned forest are within the mapped area where the optional training sessions took place just prior to the 2012 USA ARDF Championships.[6]

The Shrine Camp was the only place where the fire crossed Sunrise Highway. Fortunately, the lodge, restaurant, and stores in the town of Mt. Laguna were spared, as was the 3300-acre mapped area where the championship competitions were held. Members of the San Diego Orienteering Club and southern California radio-orienteers are looking forward to future outdoor adventures at this beautiful site.

In late June 2007, there was great concern when a wildfire broke out near Fallen Leaf Lake in the Sierra Mountains near the border between California and Nevada. Fanned by high winds, it moved rapidly northeast into a nearby residential area. Over 550 firefighters worked diligently around the clock to slow the expansion of the burn area and prevent further structure damage.

The Angora Fire became an immediate threat to the site of the USA and IARU Region 2 ARDF Championships[7] which were to take place in September. Headquarters were to be at Camp Concord, a rustic retreat two miles from the city limits of South Lake Tahoe. Full containment was finally achieved just before Independence Day, but not before 3100 acres, 242 homes, and 67 commercial buildings were destroyed. Total loss has been estimated at almost 12-million dollars.

Camp Concord was spared, as were almost all of the forest areas that were mapped for the competitions. Course setter Bob Cooley, KF6VSE, announced that a small part of his planned 2-meter area was scorched, but there were other areas that he could use as a replacement. The championships went forward and were a big success.

In Closing

The 2013 USA and IARU Region 2 ARDF Championships took place in the second week and weekend of October near Asheboro, North Carolina. Watch for a full report in my next "Homing In" column. I'd also like to cover your RDF adventures, whether in mobile and on-foot competitions or in tracking down sources of interference. Please send your stories and photos to me via e-mail. 73, Joe, KØOV

Notes

1. Electronics Research, Incorporated, http://www.eriinc.com
2. http://www.shaffercomm.com
3. Nebraska Center for Excellence in Electronics, http://www.nceelabs.com
4. More shrunken quad theory and a 2-meter design are in Chapter 12 of *Transmitter Hunting — Radio Direction Finding Simplified*, by Moell and Curlee, published by Tab/McGraw-Hill, ISBN 978-0-8306-2701-1.
5. http://www.mouser.com, stock number 659-GAA10004
6. http://www.homingin.com/laguna12.html
7. http://www.homingin.com/tahoe07.html

By Tomas Hood,* NW7US

VHF PROPAGATION

The Science of Predicting VHF-and-Above Radio Conditions

It's a Dud, Charlie

This solar cycle appears to have reached its maximum. One of the most telling signs is the expected reversal of the Sun's magnetic poles, which happens once every approximately eleven years.

"It looks like we're no more than three to four months away from a complete field reversal," said solar physicist Todd Hoeksema of Stanford University. "This change will have ripple effects throughout the solar system." (See a Science @NASA video regarding the current reversal: <http://g.nw7us.us/1fWQfgq>.)

A field reversal happens at the peak of each solar cycle as the Sun's inner magnetic dynamo reorganizes itself. The coming reversal will mark the midpoint of solar Cycle 24. Half of "solar max" will be behind us, with half yet to come.

Hoeksema is the director of Stanford's Wilcox Solar Observatory, one of the few observatories in the world that monitors the Sun's polar magnetic fields. Whenever we see the poles flipping, we know a change is happening in the sunspot cycle. Since 1976, when scientists began using magnetograms at Wilcox to track the Sun's polar magnetism, three major reversals have been observed. We now see signs of a fourth.

Solar physicist Phil Scherrer, also at Stanford, describes what happens: "The Sun's polar magnetic fields weaken, go to zero and then emerge again with the opposite polarity. This is a regular part of the solar cycle."

As the field reversal approaches, data from Wilcox show that the Sun's two hemispheres are out of sync. "The Sun's north pole has already changed sign, while the south pole is racing to catch up," Scherrer said. "Soon, however, both poles will be reversed, and the second half of solar max will be under way."

If this current reversal follows past reversals, then we can conclude that we've seen the peak of Cycle 24. And, we can acknowledge that this cycle has been the weakest 11-year cycle for quite a long while.

Will Sunspots Disappear by 2015?

Many of the sunspot Cycle 24 spots have appeared weaker than the spots seen during recent past solar cycles (see figures 1a and 1b). Could it be that sunspots are different now than during the last sunspot cycle? If so, is another cycle of some sort at work, independent of the solar 22-year magnetic cycles?

The 22-year cycle includes two 11-year cycles, and is marked by the polarity seen after two pole flips; every other flip returns the Sun's poles back to similar polarity. During the first 11 years of this 22-year cycle, the Sun's magnetic poles are opposite in polarity more than during the next 11 years.

In 1990, a time of maximum sunspot activity in Cycle 22, solar researchers led by S. K. Solanki from Zurich took advan-

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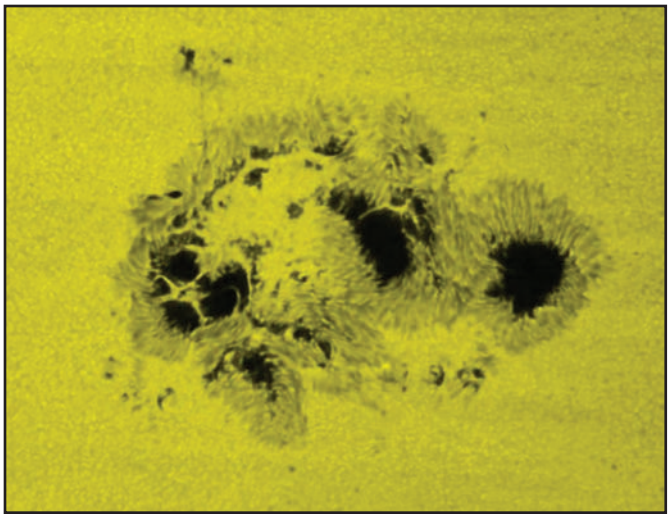

Figure 1a. An image of a sunspot from near the maximum of the last solar cycle, Cycle 23, taken at the McMath-Pierce telescope, Kitt Peak, Arizona, on 24 October 2003. The sunspots clearly show a dark central umbra surrounded by a brighter, filamentary penumbra. The magnetic fields seen here range from 1797 to 3422 Gauss. (Source: M. Penn, U.S. NSO [National Solar Observatory])

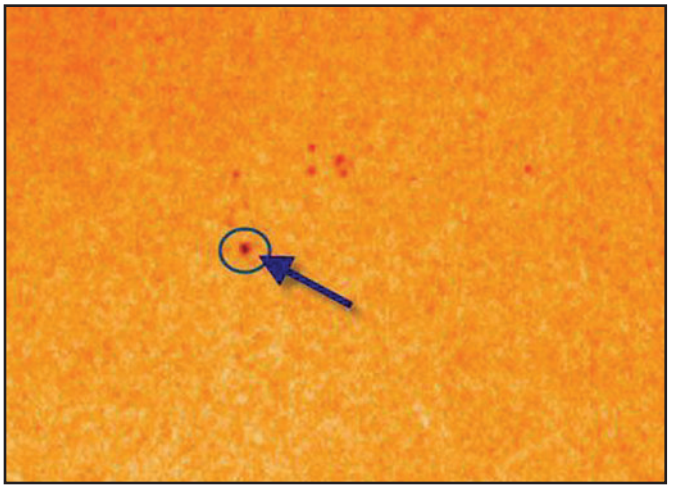

Figure 1b. An image of a pore—a tiny sunspot with no penumbral structure—taken from the MDI instrument on the SOHO spacecraft, 11 January 2009; this is an example of what we observe today at solar minimum. The larger pore had a magnetic field of 1969 Gauss. Presently, the solar surface is mostly devoid of spots. Both images (figures 1a and 1b) have the same spatial scale and are roughly 250,000 kilometers across. (Source: M. Penn, U.S. NSO)

tage of the new infrared capability at the now McMath-Pierce Solar Telescope on Kitt Peak in Arizona. They made observations of sunspots, mapping magnetic fields, along with other spectral data. These observations continued through the minimum of Cycle 22. In 1998, the observing runs were made more systematic by measuring all sunspots visible on the disk during the run. The research work has continued through Cycle 23 up to the present.

A startling trend has emerged from the data gathered in this research. In 2005, scientists led by Matthew Penn from the U.S. National Solar Observatory (NSO) closely examined these solar measurements made over the previous 13 years. The analysis indicates that the magnetic field strength in sunspots is decreasing with time, independent of the sunspot cycle. A simple linear extrapolation of the data suggests that sunspots might completely vanish by 2015! This sensational prospect was published by Penn and William Livingston (also of the NSO) in a paper published in *The Astrophysical Journal*, 649: L45–L48, 2006 September 20, entitled "Temporal Changes in Sunspot Umbral Magnetic Fields and Temperatures."

About Those Spots

Sunspots are magnetic regions on the Sun with magnetic field strengths thousands of times stronger than the Earth's magnetic field. Plasma flows in these magnetic field lines of the sun (figure 2). Sunspots appear as dark spots on the surface of the Sun.

Temperatures in the dark centers of sunspots (the "umbra") drop to about 3700 K, compared to 5700 K for the surrounding photosphere. This difference in temperatures makes the spots appear darker than elsewhere.

Sunspots usually form in groups containing two sets of spots. One set will have a positive or north magnetic field while the other set will have a negative or south magnetic field. The magnetic field is strongest in the darker parts of the sunspot. The field is weaker and more horizontal in the lighter part, called the "penumbra" (figure 3).

Since the time of Galileo Galilea, who made the first European observations of sunspots in 1610, observers and scientists have discovered a great deal about the Sun and its influence on the Earth and our atmosphere. The Chinese and many other early civilizations were the first to discover sunspots. Daily sunspot observations were started at the Zurich Observatory in 1749. By 1849, continuous sunspot observations were recorded. Over time, cycles in solar activity were revealed. The Sun's sunspot activity has a cycle that lasts for an approximate eleven-year period. The cycle starts with very quiet solar activity with very few sunspots, then peaks about three to five years later with a very high number of daily

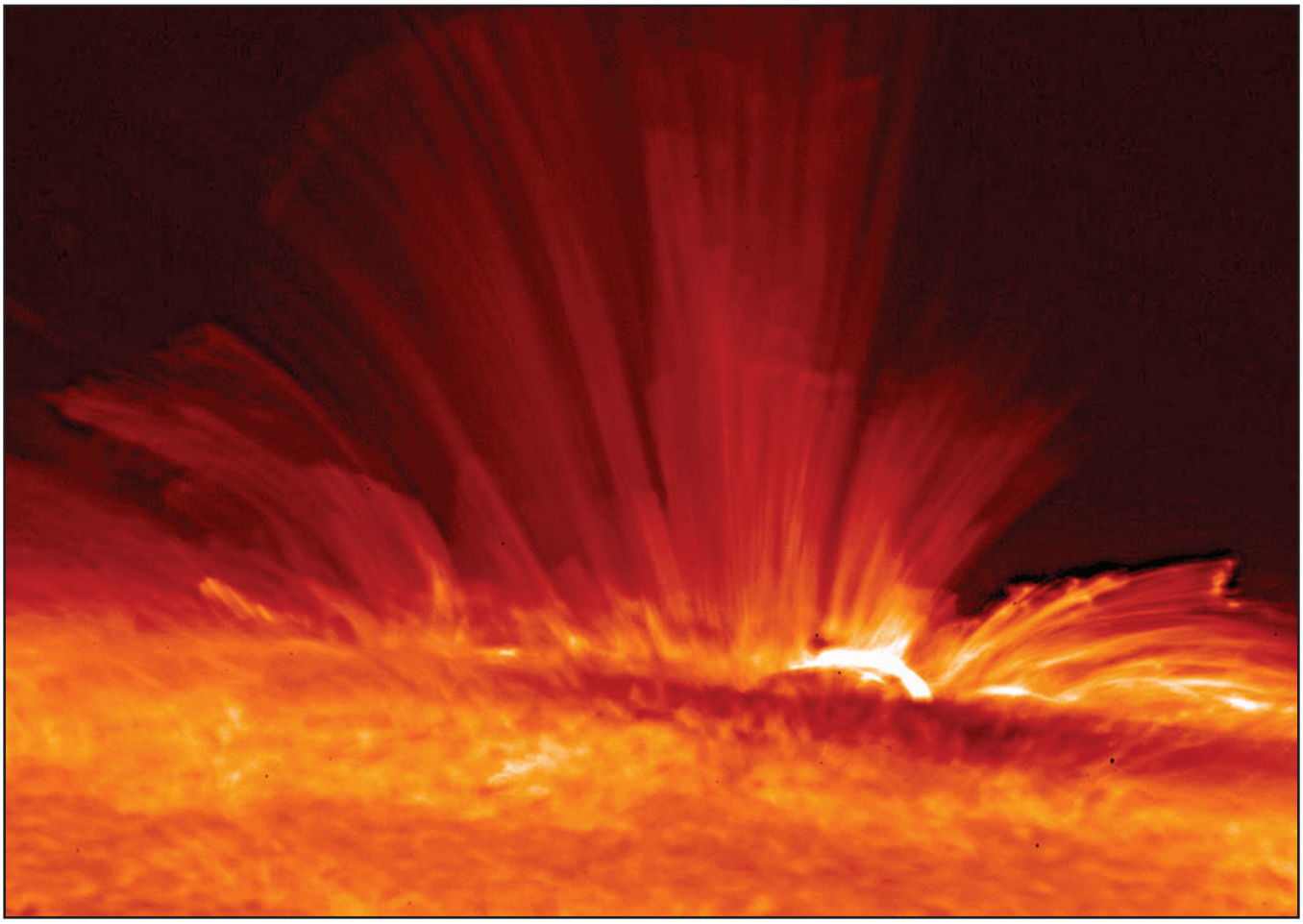

Figure 2. Solar magnetic field lines, punching through sunspots, seen in this dramatic photo of solar plasma riding these intense magnetic structures. (Photo courtesy NASA)

sunspots, and then decreases in sunspot activity until the end of the solar cycle.

In 1848, the Swiss astronomer Johann Rudolph Wolf introduced a daily measurement of sunspot number. His method, which is still used today, counts the total number of spots visible on the face of the Sun and the number of groups into which they cluster, because neither quantity alone satisfactorily measures sunspot activity.

To compensate for the many limitations of observing the Sun at various places, each daily international number is computed as a weighted average of measurements made from a network of cooperating observatories.

The Trend Continues

Three years after the first paper, the predicted cycle-independent dearth in sunspot numbers has proven accurate. An updated paper, "Are Sunspots Different During This Solar Minimum?" (published in EOS, Transactions, American Geophysical Union, Vol. 90, No. 30, 28 July 2009) reports that the vigor of sunspots, in terms of magnetic strength and area, has continued to diminish. Figure 4 shows the decrease in field strength now found with respect to time (1992–2009), which shows a linear trend independent of the solar cycle. The mean infrared intensity of sunspot umbrae is also increasing with time.

In simple terms, the sunspots observed since the 1990s have been increasing in brightness, while decreasing in magnetic field strength. When the brightness becomes the same in the sunspot as the brightness of the rest of the solar disc, we will no longer be able to see these weak sunspots. They will simply vanish, perhaps by 2015 (figure 5)!

After interviewing Dr. Penn in the "NW7US Space Weather and Radio Propagation Podcast," Episode 4, quite a few people questioned this startling research. For example, one reader wrote,

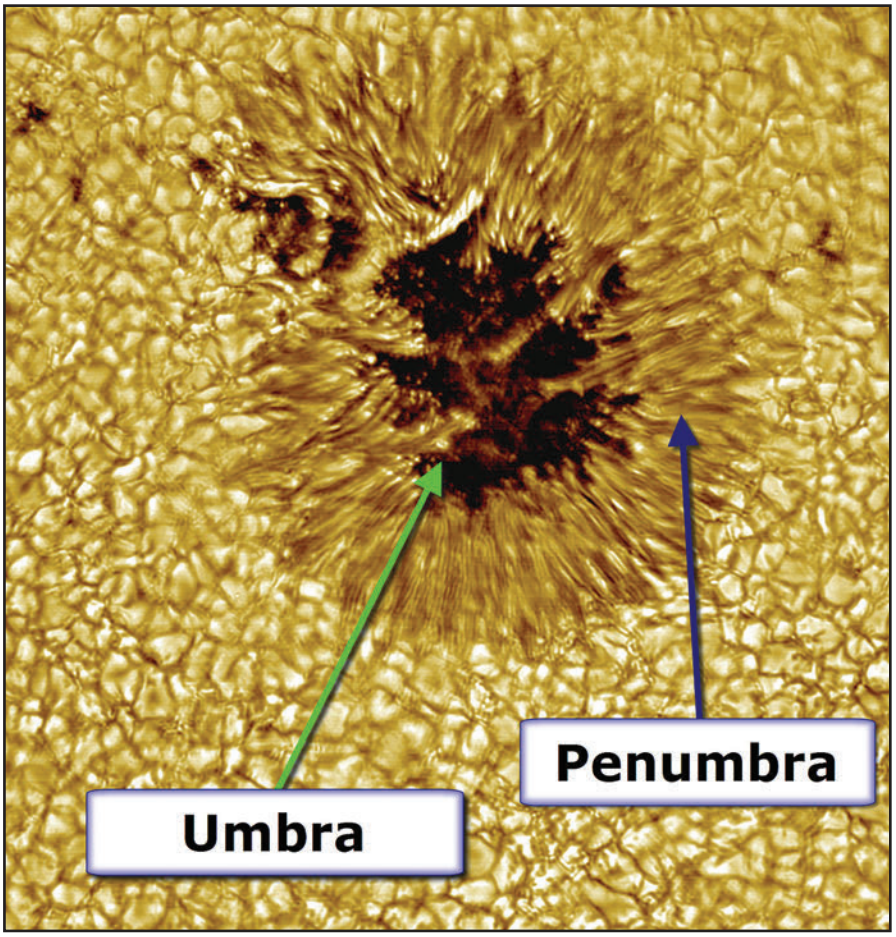

Figure 3. A sunspot, showing the darker (cooler) center, the "umbra," and the outer "penumbra." Will these clearly-defined sunspot characteristics visually disappear by 2015? (Photo courtesy NASA)

"In the 2006 journal article, I found the last sentence of the first paragraph of Observations troubling: 1. If no effort is made to prevent counting the same sunspot twice, one could, even subconsciously, favor sunspots that might favor one's hypothesis, and 2. If multiple counting is allowed and long-lived sunspots have different characteristics than shorter-lived sunspots, the data is skewed toward sunspots with longer lives because there are more opportunities to count these sunspots, more times. If I were a reviewer of this paper, I would be very uncomfortable with this sentence."

Dr. M. Penn responds:

"As you know, the Sun is highly dynamic! My colleague's observations occur only 60 days per year, so with clouds, he might have 50 snapshots of the sunspot activity. Small pores evolve from hour to hour, and even large umbrae change from day-to-day and week-to-week. His observation plan minimized bias by measuring every sunspot on the visible disk each day he observed. Without continuous observations, it's impossible to tell if a particular pore has been observed already; and worse, without seeing the far-hemisphere of the Sun, it's impossible to tell even if large umbrae appearing on the eastern limb have been observed on their previous rotation. Equally important is the fact that not all sunspots could be observed.

"Selection bias was extensively tested in this and following work. Larger sunspots tend to live longer and thus have a higher probability of being observed multiple times. The data sets were examined to measure the behavior of different-sized spots, and each size bin showed the same time variation; large spots by themselves showed the same trends that small spots by themselves showed.

"We know the sample is incomplete, but with the testing we've done we think that multiple measurements do not introduce a bias which would cause the time variation.

"As far as an observer-introduced bias, my colleague is internationally known as a very patient and excellent observer. It's hard to imagine that during the course of 13 years he (consciously or not) subtly changed his sunspot selection to introduce a linear trend, and further that his personal bias would eventually agree with the fact that the next solar minimum would be longer than usual! Furthermore, current work on automatically selected sunspots from archival data bases supports these IR observations."

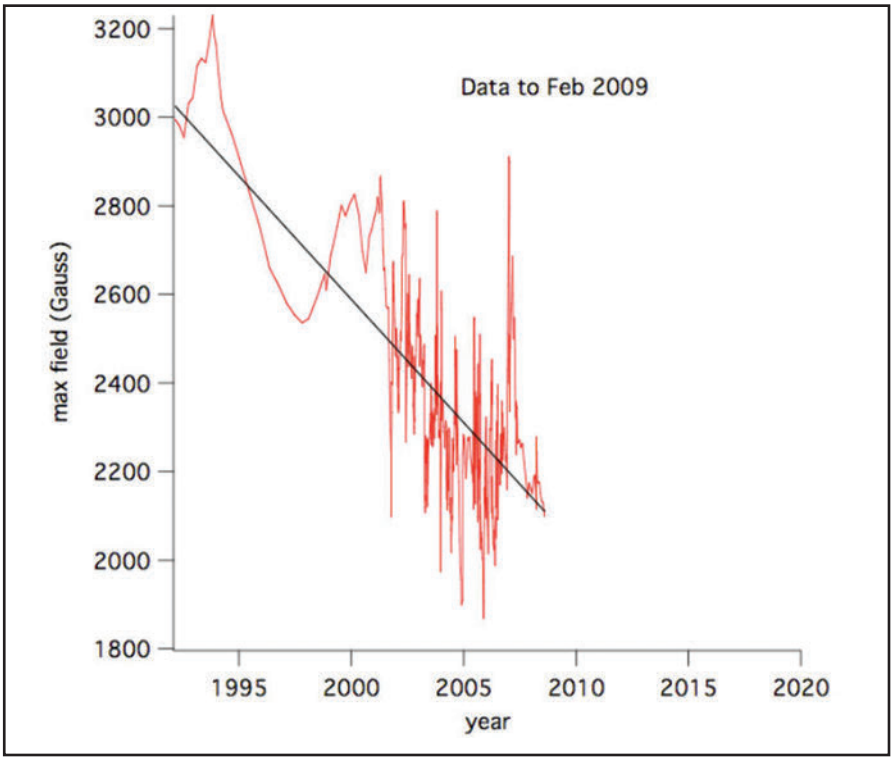

Figure 4. The maximum sunspot field strength is plotted versus time, during the period from 1992 to February 2009; a 12- point running mean is shown, and a linear fit to the data is plotted. Apart from a few measurements, the linear trend has been seen to continue throughout this solar maximum. (Source: M. Penn, U.S. NSO)

In several years' time, will we see that sunspots exhibit the continued decline in strength? This column will continue to report on whether or not this trend is continuing.

Meteors

One of the largest yearly meteor showers occurs during November. Check out the summer 2013 edition of this column for more information on how to work meteor showers.

For the 2013 *Leonids* shower, meteors will appear to radiate out of the constellation of Leo from the second week of November, peaking around the middle of the month, and then tapering off through to the end of November. We hope each year for a storm event, with more than 200 meteors per hour.

With a high hourly rate, even tiny patches of ionized *E*-region meteor trail in sufficient quantity could support VHF propagation. Because of the latest advances in our equipment, including very powerful soundcards and computer hardware, married with the right software, you have an excellent opportunity to work this shower.

This year, the best window to start trying meteor-scatter mode is early evening. Then, the shower should pick up as midnight rolls by, and then peak around 2 AM, local time, tapering off as morning arrives. Any night between the 14th and the 22nd might be good, with the peak expected on November 17, 2013.

Watch for the *Ursids* from December 17 through the 26 with a maximum on December 22. Most people miss this, but it could have an hourly rate as high as 50. In 2008, it reportedly had two peaks with an hourly rate of 30 to 35. The *Ursid* radiant is circumpolar from most northern locations, and culminates after daybreak, while it is highest in the sky later in the night. This one could be a good VHF player.

The *Geminids* is possibly the most reliable of the annual showers. While the duration of this meteor shower is shorter than that of others, there's a definite plateau of maximum activity. The *Geminids* begins to peak during predawn on December 13, with a quick climb to its maximum rate of around 120 per hour,

according to forecasts. Its window is from December 4 through 17. In North America and Canada, VHF enthusiasts will have the best opportunity to work meteor-scatter propagation from December 12 through the wee hours on the 14th, but as the *Geminids* is a "long tail" event, expect continual opportunity, though less often, several days or nights after the peak.

Don't forget to send in your stories and reports of your experience with meteor scatter. Other readers and I would love to hear about them!

The Solar Cycle Pulse

The (preliminary) observed sunspot numbers from June through September 2013 are 52.5, 57.0, 66.0, and 36.9. The smoothed sunspot counts for December 2012 through March 2013 are 59.6, 58.7, 58.4, and 57.5.

The monthly 10.7-cm (preliminary) numbers from June through September 2013 are 110.2, 115.6, 114.7, and 102.7. The cycle certainly seems to be decreasing in strength, but somewhat slowly. The smoothed 10.7-cm radio-flux numbers for December 2012 through March 2013 are 120.1, 118.9, 118.0, and 117.1.

The smoothed planetary *A*-index (*Ap*) numbers from December 2012 through March 2013 are 7.5, 7.5, 7.4, and 7.4. The monthly readings from June through September 2013 are 13, 9, 9, and 5.

The monthly sunspot numbers forecast for November 2013 through January 2014 are 75, 76, and 78, while the monthly 10.7-cm flux forecast is 129, 130, and 131 for the same period. Give or take about eight points for all predictions.

(Note that these are preliminary figures. Solar scientists make minor adjustments after publishing, by careful review.)

Feedback, Comments, Observations Solicited!

I am looking forward to hearing from you about your observations of VHF and UHF propagation. Please send your reports to me via e-mail, or drop me a letter about your VHF/UHF experiences. I'll create summaries and share them with the readership. I look forward to hearing from you.

Up-to-date propagation information is found at my propagation center, at <http://sunspotwatch.com/>. If you are using Twitter, follow @hfradiospacewx for space weather and propagation alerts, and follow @NW7US to hear from me about various space weather and amateur radio news. Facebook members should check out the CQ VHF Magazine Fan Page at <http://www.facebook.com/CQVHF>, and the Space Weather and Radio Propagation Group at <http://www.facebook.com/spacewx.hfradio>. Until the next issue, happy weak-signal DXing!

73 de NW7US, Tomas Hood

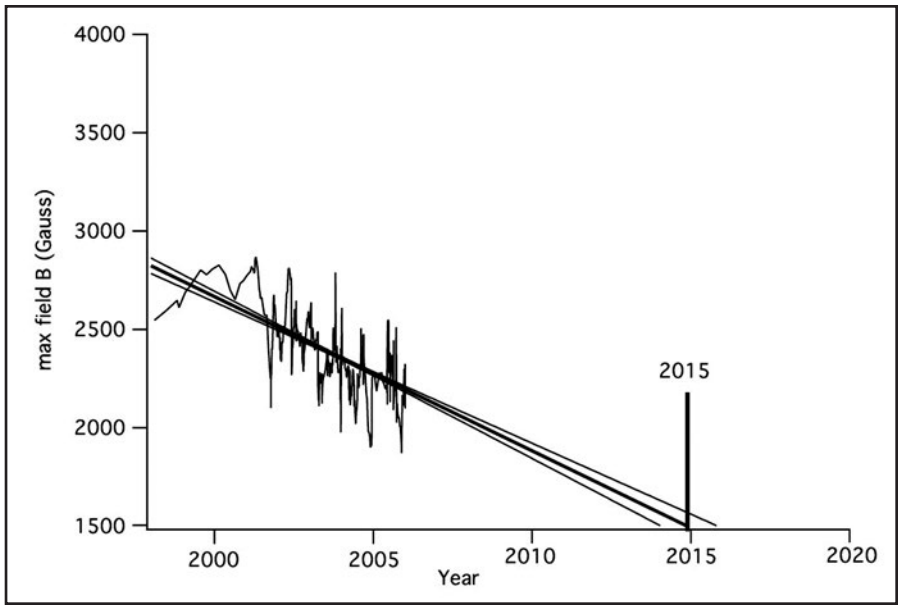

Figure 5a. A linear fit to observed magnetic fields extrapolated to the minimum value observed for umbral magnetic fields; below a field strength of 1500G as measured with the Fe I 1564.8nm line no photospheric darkening is observed. (Source: M. Penn, U.S. NSO)

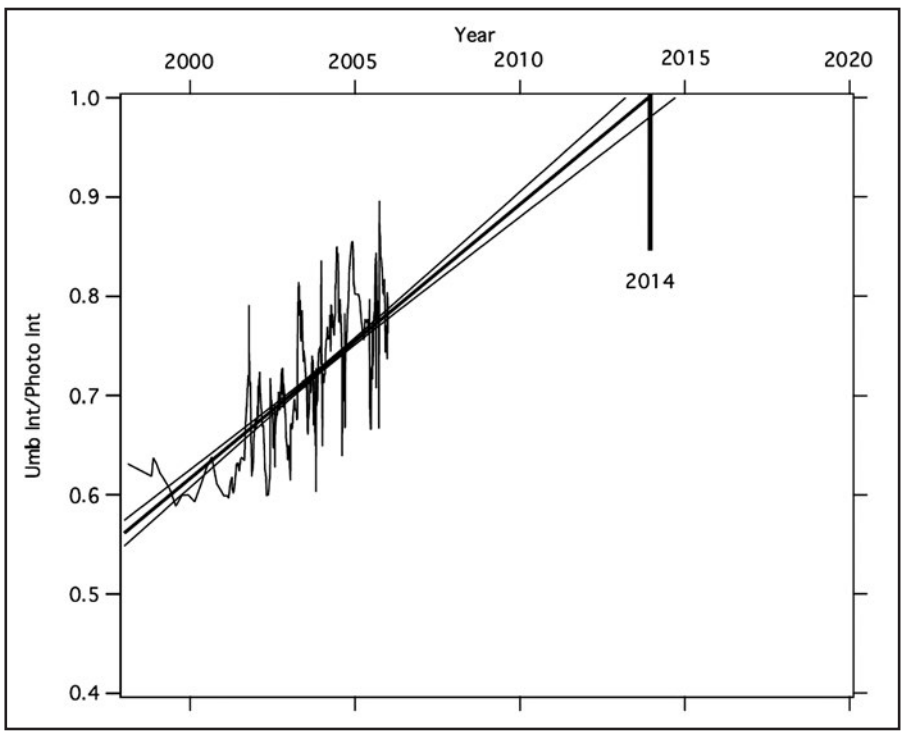

Figure 5b. A linear fit to the observed umbral contrast values, extrapolated to show that by 2014 the average umbrae would have the same brightness as the quiet Sun. Source: M. Penn, U.S. NSO)

By Kent Britain,* WA5VJB

ANTENNAS

Connecting the Radio to the Sky

Driven Elements

In this issue we will talk about driven elements. There are a lot of reasons to use one driven element rather than another, and there also are some interesting "old wives' tales" I want to cover.

In figure 1, I have the basic structure of a Yagi antenna. Note that I did not include the driven element. The driven element has very little to do with the gain and pattern of a Yagi! The driven element merely excites the Yagi structure. There are mechanical and impedance advantages to different driven elements, but they do not change the pattern.

OK, now back to you guys—and you know who you are—the ones who like to pick fly specs out of pepper. Yes, you can induce a few hundreths of a dB gain or front-to-back ratio change with drastic changes to the driven element, but these would not be measurable on an antenna range. And the effects of the impedance changes far outweigh the pattern changes.

Let's start with the most interesting popular idea about Yagis, shown in figure 2. Here we have three Yagis. The first one has a very long driven element, the second has a more conventional length, and the third has a driven element that is shorter than the first director.

Of course 2A can't work because the driven element is too long. It's longer than the reflector and all the signal will just go out the back. Well, 2B is the proper way, just right. And 2C can't work because the element is too short and the signal will never get around the first director.

Sorry, guys, but if all three are impedance matched—that is, get the SWR down—there is virtually no difference in the performance of the three driven elements. Again, it's the Yagi structure that is providing the gain and pattern, not the driven element. Perhaps it is the very long driven element that has stirred up the most controversy. K5GW has done quite a bit of work in this area, and I recently confirmed Gerald's work on another project.

The classic 1/2-wave dipole has 72 ohms impedance. When you make the dipole shorter, or longer, the impedance changes. Make the dipole longer, and the impedance goes up with a positive phase shift (+j). Make the dipole shorter and the impedance goes down with a negative phase shift (–j). You can do a lot of impedance matching by changing the length of the driven element, and if the driven element ends up longer than the reflector, so be it!

So why would one choose one driven element design over another?

Other than personal preference, or a company patent, the most important reason to use one driven element design over another is impedance.

First we need to go back to that Maxwell equation of 120 pi, or 377 ohms for the impedance of free space. A radio wave traveling though a transmission line has an impedance. Coax is typically 50 ohms, twin lead 300 ohms, and that radio wave zipping across the universe sees the universe as a transmission line with

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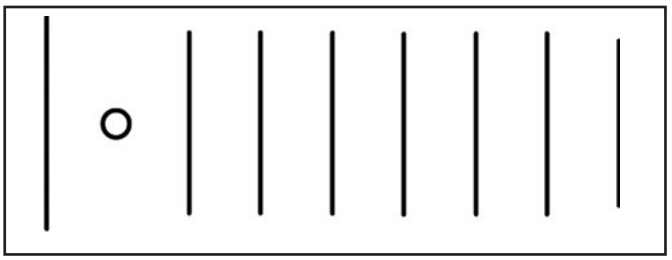

Figure 1. Basic Yagi structure.

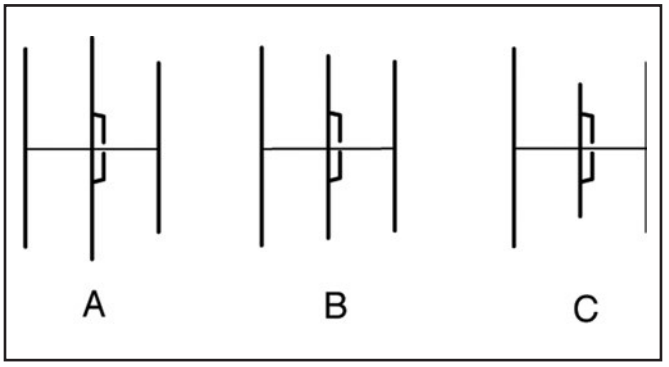

Figure 2. Driven element lengths.

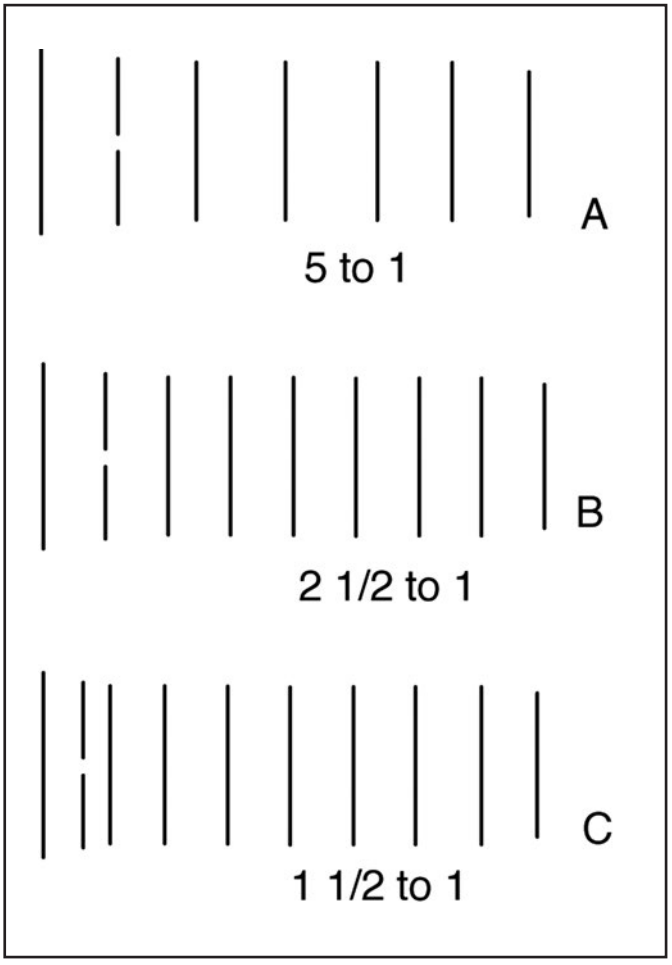

Figure 3. Yagis as impedance transformers

377 ohms impedance. OK, OK, back to the guys looking for fly specs. Allow a few tiny variations in that 377 ohms for atmospheric density and relative humidity. Now whack yourself up side of the head with your slide rule or scientific calculator.

In short, an antenna is a transformer that transforms your 50-ohm coax to 377 ohms as the signal heads into free space, and of course the other way around on receive.

It's kind of hard to think of that 40-meter inverted-V fed with 50-ohm coax as a 7.5-to-1 impedance transformer to 377 ohms, but it is.

Now take a look at figure 3, where I simplify different Yagi configurations.

First, 3A is the wide-spaced version. A wide-spaced Yagi behaves as a transformer with an impedance ratio of about 5 to 1. This means I want a driven element with an impedance of 377/5, or about 72 ohms. Just a plain dipole with a tweak or two to its length should work just fine as a driven element.

With the more common spacing in version of 3B you see an impedance ratio in the range of 2 or 3 to 1. Now we are looking for a driven element with an impedance of 125 to 200 ohms. With a T match, gamma match, or the popular dipole with a 4 to 1 balun, you've got it. Of course, my favorite simple driven element, the "J" used on the Cheap Yagis, falls in this ratio range with an impedance of about 150 ohms when mounted by itself. Interestingly, I did see a report from a VK who claims I have it all wrong for 150 ohms and he had an NEC model to prove it. His simple model had four 90-degree joints, and anyone working with NEC quickly learns that NEC does not model 90-degree joints well. I stand by my 150 ohms. This is also an issue with the NEC models of LFA (loop fed array) Yagis where the loop driven element is modeled as a simple square with four 90-degree joints. Guys, you have to make that LFA driven element at least 8 wires, and 12 wires is even better.

With the very closely spaced Yagi in version 3C you will see an impedance ratio in the range of 1.5 to 1. About the only driven element for this configuration is the folded dipole with its 300 ohms or so impedance. These were very popular with the F9FT family of Yagis. The down side is that the dimensional tolerances get very tight. The elements are quite close together and those spacings are very critical.

If you have worked with YO, YagiMax, NEC, or any of the other Yagi programs, you know all too well that just about any change in element spacings and element lengths affects the driven element impedance. This is why I have kept the impedance ratios in three broad catagories. For the rest of you, yes, the dimensions are important.

At this point I will lightly touch on the topics of weather and mechanics. Joints tend or corrode over time. The more joints, the more dissimilar metals, the more problems you will have over the years and with the age of the antenna. There is a lot to be said for the KISS principle: Keep It Simple, Stupid

Future Projects

I think I'm on a roll here and will continue to cover the different driven element configurations in the next issue of *CQ VHF*. As always, we welcome questions and column suggestions from our readers. An e-mail to <wa5vjb@cq-vhf.com> or even a snail mail to my QRZ.com address will work. And for other antenna projects you are welcome to visit my website <www.wa5vjb.com> and look in the Reference section.

73, Kent WA5VJB

By Dr. H. Paul Shuch,* N6TX

DR. SETI'S STARSHIP

Searching For The Ultimate DX

Academician

At the recent International Astronautical Congress in Beijing, the author (left) congratulates Voyager mission manager Ed Stone on his child finally leaving the solar system. "Some of us," said Paul, "are still trying to figure out how to get our children to leave the house."

One of my most pleasant duties during my two decades of involvement with The SETI League has been participating as a member of the SETI Committee of the International Academy of Astronautics. The IAA established this committee to help in creating protocols to be followed in the conduct of SETI research, with emphasis upon the critical question of what to do should detection of a credible candidate signal occur. Since the 1970s, the world's leading SETI scientists have met annually in conjunction with the International Astronautical Congress (IAC).

I've been to these meetings on six continents now (and am still waiting for the penguins to host one, so I can make it a clean sweep of all seven). The participants are a veritable who's who of SETI science and technology, and their names probably would be familiar to many readers of this column. In fact, it should not be a surprise to you to discover just how many of them happen to be radio amateurs (and, in fact, SETI League members).

At the most recent IAC, held in Beijing in September 2013, we had something extraordinary to celebrate. Perhaps you read that the Voyager 1 spacecraft, launched in 1976, had finally found its way to the heliopause, becoming the first human artifact to leave our solar system, to drift forever through interstellar space. The announcement was made by Prof. Edward Stone of Caltech, who has served for most of his professional life as the manager of the Voyager interplanetary (and now, interstellar) mission.

IAA President and Caltech Prof. Edward Stone inducting the author as a Full Member of the International Academy of Astronautics (September 2007, Hyderabad India)

The two Voyager spacecraft hold special significance for UHF/microwave radio amateurs. Each carries both S-band and X-band transmitters used for returning to Earth images and scientific data collected on the two space probes' grand tours of the outer planets. Those same transmitters have been employed by hams worldwide, both for system calibration and as exotic DX beacons to challenge the most sensitive of terrestrial receivers. Of course, too, radio astronomy and SETI observatories long used those same beacons to verify the proper operation of their receiving systems, until distance, power-source degradation, and the inverse square law all conspired to make them undetectable to our modest microwave ears.

As a result of my participation in the IAA SETI Committee, I eventually found myself elected to academy membership. At the time of my nomination, the vice-president of the academy (and later its president) was that

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same Caltech professor Edward Stone, also known as the former Director of the Jet Propulsion Laboratory.

All of this takes me back a few decades to my first meeting with Stone, while a graduate student, and thence to more recent encounters with him in France and India:

When I was in Berkeley, at the University,
Just around the time that I had earned my PhD,
NASA had a mission, not exploring distant stars,
Just the outer planets in their orbits beyond Mars.
Voyager was managed by a team at JPL,
Led by a professor, Edward Stone. He came to tell
All the engineers about his mission's great success.
I went there to meet him, and impress him, I confess.

After Edward Stone had given his amazing talk,
Straight up to the podium I quickly took a walk,
Boldly introduced myself, and gave him my CV,
Told him I had just completed my own PhD,
That I was a Space Communications Engineer,
And that JPL could use my skills. I made it clear
I had much to offer to the Pasadena team,
That they ought to hire me and fulfill my lifelong dream.

Pocketing my resume, both patient and polite,
Stone explained he couldn't hire me on the spot that night,
Promised that when he got home, he'd very surely tell
All about my interest to his Chief of Personnel.
Forcefully and confidently, I pressed my attack,
Realizing odds were I would not be hearing back,
Feeling lucky intercepting such a busy guy,
Not too disappointed at receiving no reply.

Let's fast forward to two thousand one. For by that year,
I'd seen recognition and success in my career.
Now a Full Professor, I was very recently
Nominated to the International Academy
Of Astronautics. As it happens, their Vice-President
Was Professor Edward Stone. And so it was I went
To an Astronautical Convention in Toulouse,
Hoping to meet colleagues, do some networking, and schmooze.

Walking to the conference center one September day,
I saw Ed Stone walking down the path the other way.
When we passed, his eyes betrayed a glint of recognition.
"Say," he asked me, "did you ever garner that position
Down at JPL?" I said no. Edward shrugged, "Oh, well.
Rest assured I gave your resume to Personnel."
I was quite impressed by Stone's amazing memory.
He became, and still remains, an honored friend to me.

Six years passed. The IAC met in Hyderabad.
I was being honored, and so I was very glad
Ed Stone was now President, for he presented me
With my Senior Membership in the Academy.
Stone and I are both retired now. We meet every year
At astronautics meetings run by younger engineers.
For decades, I've continued to enjoy Stone's company,
Glad he spoke in Berkeley, at the University.

Paul, N6TX

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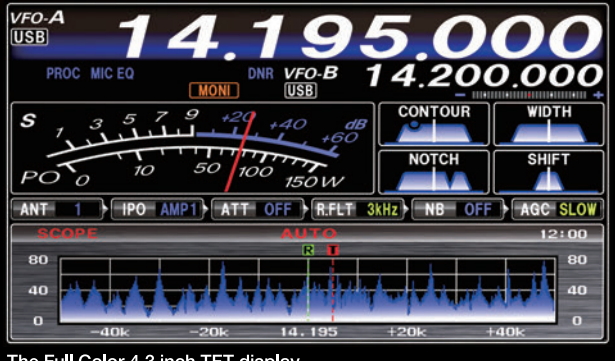

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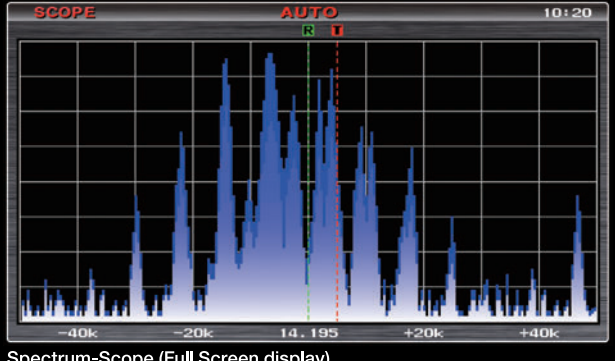

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